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# UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED QUARTERLY FOR THE INFORMATION OF  
THE MEDICAL DEPARTMENT OF THE NAVY



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NAVY DEPARTMENT,  
*Washington, March 20, 1907.*

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,  
*Acting Secretary.*

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## PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, notes, and comments on topics of medical interest, and reviews or notices of the latest medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

*Surgeon General United States Navy.*



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The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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# U. S. NAVAL MEDICAL BULLETIN

VOL XXX

JANUARY, 1932

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## SPECIAL ARTICLES

### BELIEF WORK IN THE MANAGUA EARTHQUAKE

By G. D. HALL, Commander, Medical Corps, United States Navy, and H. R. Boone,  
Lieutenant Commander, Medical Corps, United States Navy

Managua, the capital city of the Republic of Nicaragua, is situated on the southern shore of Lake Managua about 30 miles from the Pacific coast. It is connected by rail with Corinto, Nicaragua's port on the Pacific coast. The railroad passes through Leon terminating at Granada which is located on Lake Nicaragua about 40 miles east and south of Managua.

Within a radius of 40 miles of Managua there are 3 active volcanoes and several crater lakes.

The population of Managua, prior to the earthquake, was estimated at 60,000. At this time there were stationed in the city about 80 United States Marine and Navy officers, 650 enlisted men of the United States Marine Corps and Navy, and about 150 wives and children of officers and men.

With the exception of the barracks buildings recently erected in the marine compound (Campo de Marte) and a very few reinforced concrete structures in the city, practically all the construction consisted of lava block or adobe, built around a central patio and covered with tile roofing. These tiles were laid over a highly inflammable wooden and reed framework. This type of architecture added greatly to the earthquake and fire hazard. In this connection it might be stated that there were a few fire hydrants in the city itself, but other than a limited amount of hose and chemical fire carts belonging to the marines, there was no fire fighting apparatus or city fire department.

The city water supply comes from a crater lake (Lake Asososca) located about three miles west of the city. However, only about one-third of the houses were connected with this system. Shallow wells located close to the houses and over which there was no sanitary control, furnished the water supply for those houses not connected with the city system.

There is a sewerage system covering that part of the city where there are paved streets. This area includes mainly the business and better residential sections, but for the most part the sewage is drained

into cesspools located in the patios. These offer a constant source of contamination, especially during the rainy season, to the wells which are often close by.

The main food purchasing center for the city was in a large native market, the buildings covering an area of two city blocks. This was of typical native construction. This market, especially during the morning hours, was densely crowded. It was used by the natives not only as a market, but as a daily meeting place.

In the western outskirts of the city was the National Penitentiary, a huge lava block structure, in which about 350 prisoners were confined. The Guardia Nacional had charge of this institution. It was in this place and in the market that the greatest loss of life occurred.

The civil medical facilities, prior to the earthquake, consisted of a general hospital of 600-bed capacity under the charge of Catholic sisters. The staff was composed of native physicians. The hospital covered a large area, was of the usual adobe construction, except for one new wing, the walls of which were concrete. With the exception of this wing, which was badly damaged, the entire hospital was demolished. There were about 450 patients in this institution at the time of the earthquake. The only other civil hospital was located on the extreme eastern edge of the city. The Baptist Missionary Society is in charge of this institution. An American resident physician and three American nurses compose the staff. This hospital was completely demolished, but there was no loss of life.

The headquarters and laboratories for the general sanitation of the country are located in Managua. This activity is under the direct charge of the Minister of Health. The laboratories were equipped and personnel trained by the Rockefeller Foundation.

The military medical facilities consisted of the brigade field hospital, aviation medical department, and the hospital of the Guardia Nacional with a combined bed capacity of about 100. The brigade field hospital was located in the marine compound. The main hospital building which included the operating room was destroyed, but the sick officers' quarters and a ward building remained habitable. The guardia hospital, which was located in the guardia portion of the campo, was completely demolished. To the brigade hospital were attached 2 medical officers—Lieut. Commander W. B. Hetfield and Lieut. Commander W. T. Brown, 1 chief pharmacist—L. H. French, and 31 Hospital Corps men. The medical personnel of the Guardia Nacional on duty in Managua consisted of: Commander G. D. Hale, Lieut. Commander H. R. Boone, Lieut. Commander H. F. A. Baske, Chief Pharm. Roy Aikman, 4 United States



2-1      **FIGURE 1.—TYPICAL RUINS SHOWING ADOBE CONSTRUCTION**





FIGURE 2.—RUINS OF NATIONAL PENITENTIARY

2—2



Navy and 12 native Hospital Corps men. Lieut. Commander Baske, who was holding sick call in the penitentiary at the time of the earthquake, was instantly killed. There were no other fatalities among the medical personnel.

On the morning of Tuesday, March 31, 1981, the city of Managua was sweltering in the heat of the dry season. There had been no rain for six months. By 10 a. m. the market place was unusually crowded owing to the fact that it would be closed for the remaining days of Holy Week. At 10.28 a. m. the city was in ruins. An earthquake lasting only six seconds had rendered practically every house uninhabitable with a fatality list of 1,000, and 5,000 injured. Within 10 minutes fire had broken out, presumably starting in a drug store adjacent to the market and simultaneously in stores close by where fireworks for the celebration of Holy Week were for sale. The greatest intensity of the earth's movement was localized over an area about four miles in width. This area embraced the water-works on Lake Asososca and National Penitentiary to the west, extending across the city to its extreme eastern edge.

In order to meet this emergency martial law was declared almost immediately (11 a. m.) by the jefe director of the Guardia Nacional, and very shortly the marines and guardia were patrolling the city.

As the water-supply system was put out of commission, commandeered trucks were at once placed in service carrying properly chlorinated water in gasoline drums to various designated points in the city. Two wells, one at the brewery and the other at the ice plant, both undamaged, were the source of this supply. Guards were placed over them, and each drum as filled was heavily chlorinated by using calcium chloride bombs. This method was continued until April 7, when an auxiliary pumping system, with a modern chlorinating plant, was repaired and placed in commission. Mr. Magoon, an expert hydraulic engineer of the Rockefeller Foundation who arrived in Managua by plane from Guatemala shortly after the earthquake, was in charge of this work. This system was the one in operation prior to the installation of the present Asososca supply, the water being obtained from three large abandoned wells on the lake front. This system supplied only a portion of the city; thus it was necessary to continue delivery by truck to certain localities until the regular water supply from Lake Asososca was placed in operation on April 24. The water mains were not greatly damaged, but the pumping station on Lake Asososca was buried beneath a landslide. Extensive work was necessary before this plant could be repaired and recommissioned.

The fire swept rapidly over large portions of the central business and residential sections, and it was only after several days that the

efficient dynamiting, carried out by the United States Army Engineers from Granada, brought it under control.

During the first few days the many bodies recovered from the ruins were buried in a common grave near the destroyed National Penitentiary. Later the new City Cemetery was used for this purpose. As time went on the bodies that were found were well covered with kerosene and burned on the spot. This procedure was necessary owing to the far advanced state of decomposition. To date, 973 have actually been accounted for.

Within a very short time the service families and other American residents were assembled in the Campo de Marte. On the 3d and 4th of April the American women and children and all severe service injured were evacuated by plane to Corinto on the first stage of their journey to the United States.

By 11 a. m. the brigade, aviation, and guardia ambulances together with many trucks were bringing wounded from all parts of the city into the campo.

The medical personnel of the brigade and guardia combined resources and installed four operating units in tents adjacent to the demolished main building of the brigade hospital.

The cases on arrival in the campo were first sorted out in accordance with the apparent severity of their injuries by Chief Pharmacist Aikman and his assistants. From noon until midnight a constant flow of badly mutilated cases were treated. The four operating tables were in continuous use during this period. They were manned by the brigade and guardia medical officers, assisted by Maj. P. R. Hawley, Medical Corps, United States Army, who arrived by special train from Granada within a few hours after the earthquake, and Doctor Periera, a Nicaraguan physician. The cases treated were for the most part crushing injuries of the extremities, severe lacerations, compound and simple fractures, and dislocations of which four were of the hip. Six cases of fracture of the spine with resulting paralysis were seen. There were also several basal fractures of the skull. There were approximately 150 cases of the above-mentioned types. The treatment was essentially emergency. With few exceptions all the severely injured cases were given a general anæsthetic. Amputations were necessary in practically all of the crushing injuries. Thomas splints were used for the fracture cases until the supply was exhausted, then it was necessary to resort to various types of improvised splints. In general the severe lacerations, on account of the probability of infection were not sutured. The active hemorrhage was stopped and the wounds dressed with sterile gauze. Hundreds of minor injuries were also cared for during this period and all injured were given the pro-



FIGURE 3.—POSTOPERATIVE CASES IN MARINES' MOVING-PICTURE HALL

4-1





FIGURE 4.—VACCINATING AT A FOOD-DISTRIBUTING CENTER

4-2

phylactic dose of tetanus antitoxin. After treatment, the cases were placed on mattresses, cots, and tijeras in the sick officers' quarters of the brigade hospital, in tents which had been put up on a grass plot in front of the old guardia hospital, and in the marine movie hall.

Mrs. Mauldin, wife of Lieut. H. E. Mauldin, Dental Corps, United States Navy, Mrs. Williams, and Mrs. Jackson, wives of marine noncommissioned officers, all of whom were graduate nurses, and the three American nurses attached to the Baptist Missionary Hospital (Miss Woodburn, Miss Rice, and Miss Tanner) rendered invaluable service.

It was soon evident that some scheme of evacuation had to be decided upon, as with limited hospital facilities, inadequate water supply, and no sanitary conveniences such a large number of wounded could not receive the proper care during the strenuous days we anticipated. The train service west to Leon was out of commission, but hospital facilities were available in Granada, Masaya, and Jinotepe. Major Hawley volunteered to receive and distribute on arrival such cases as would be sent to Granada. Special trains were arranged for, and on Thursday and Friday, April 2 and 3, a total of 90 patients was transferred to the hospital in Granada. On Saturday, April 4, 35 patients were sent to Masaya, and the following day, April 5, 18 patients were sent to Jinotepe.

On Wednesday, April 2, a tent hospital was in readiness. This was located on the golf course on Loma Field, which adjoins the Campo de Marte on the south. After the first evacuation to Granada on April 2, all remaining cases were sent to this hospital. Here they remained until the more serious cases were finally evacuated as stated above. This hospital was operated by the Guardia Nacional medical department and cared for all civilian and guardia patients. Later two houses were reconditioned, one as a Guardia Nacional hospital and the other as a civil hospital.

On April 1, United States Navy medical units arrived by plane from Coco Solo, the U. S. S. *Lexington* and U. S. S. *Saratoga*. The two airplane carriers were detached from maneuvers in the Caribbean, and proceeded toward the east coast of Nicaragua where these planes were launched for Managua. These units consisted of the following:

*Coco Solo, C. Z.*—Lieut. Commander H. S. Harding, Medical Corps, United States Navy; Lieut. (Junior Grade) W. K. Hicks, Medical Corps, United States Navy.

*U. S. S. Lexington.*—Lieut. (Junior Grade) J. H. Korb, Medical Corps, United States Navy; Lieut. (Junior Grade) M. D. Dickinson, Medical Corps, United States Navy.

*U. S. S. Saratoga*.—Lieut. Commander V. S. Armstrong, Medical Corps, United States Navy; Lieut. (Junior Grade) A. W. Loy, Medical Corps, United States Navy.

These units brought medical supplies, vaccines, blankets, cots, etc., which were by this time urgently needed. On the evening of their arrival a conference of all medical officers was held and the personnel was assigned to various activities, including the brigade hospital, guardia tent hospital, penitentiary, and city sanitary work. The duty performed by these medical officers and corps men was most satisfactory and their timely arrival and assistance was greatly appreciated by the medical officers regularly on duty in Managua.

On April 2, by presidential proclamation, a sanitary commission was appointed consisting of the following: Dr. Frederico Arana, president; Commander G. D. Hale, Medical Corps, United States Navy, vice president; Lieut. Commander H. S. Harding, Medical Corps, United States Navy, member; Chief Pharm. Roy Aikman, United States Navy, member; Dr. Jacinto Perez, member; Dr. Carlos Cuadra, member; Dr. Tomás Pereira, member.

This commission was invested with full powers for the general sanitary control of the city. The first step was to divide the city into four sections and at a strategic point in each section headquarters were established.

During the days immediately following the disaster Red Cross units arrived from Mexico, from each of the sister Central American Republics, and from Leon, Chinandega, and Rivas, neighboring cities in Nicaragua. One of these units was assigned, by the commission, to each city district. Their duties consisted of supervising the sanitation of that district, locating cases of serious illness and transferring same to the guardia tent hospital, treating minor injuries, giving typhoid prophylaxis, etc. The remaining Red Cross units were assigned as follows:

The unit from Panama was sent to Granada where they established and operated a hospital caring for about one-half of the cases evacuated to that place. Upon the departure of this unit, after about two weeks stay, this hospital was taken over by Major Hawley, who is continuing the treatment of the cases.

The unit from Guatemala, under the charge of Doctor Espinosa, devoted its activities to the excavation of bodies principally from the ruins of the old city hospital. Much property belonging to this hospital was salvaged. Before this unit left it opened a new city hospital in a house, which after considerable work was made habitable. This hospital is still being used.

The unit from San Salvador not only did first-aid work, but distributed food to some hundreds of persons daily. Other units were sent to Masaya and Leon to which cities many refugees had gone.

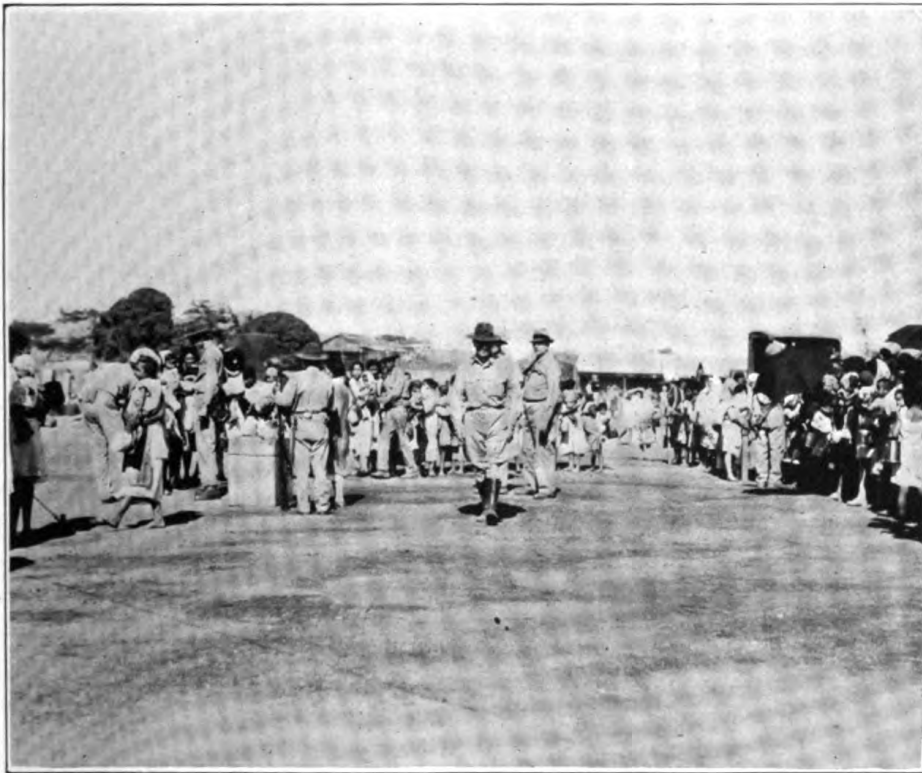


FIGURE 5.—FOOD-DISTRIBUTING CENTER OF THE AMERICAN RED CROSS

6-1





FIGURE 6.—FOOD-DISTRIBUTING CENTER OF THE SAN SALVADOR RED CROSS

6—2



Refugees left the city in large numbers using every available means of transportation. The roads leading out of Managua were crowded for days with automobiles, bull carts, etc., loaded to capacity with families and their salvaged household possessions. Only when the free distribution of food in the neighboring cities was discontinued did these refugees gradually return to Managua creating an additional burden to an already trying situation. Meanwhile the marines, on April 1, had established a refugee camp on the La Loma Field. To this camp women, children, old persons, and others not assigned to work were ordered. This refugee colony soon assumed large proportions. Tentage and cooked food were supplied to thousands for several days. The sanitation of this camp was supervised by the brigade medical officers.

Mr. Ernest J. Swift, disaster expert of the American Red Cross, arrived from Washington by plane on April 4. Upon his recommendation a central committee was formed with the American minister, Matthew E. Hanna as chairman, and General Somosa representing the President of Nicaragua. The other members were the brigade commander, the jefe director of the Guardia Nacional and the commanding officer of the United States Army Engineers. The first consideration of the committee was food distribution. Up to this time the marines had continued the distribution of cooked food to the destitute population. Two main distributing centers were now opened by the American Red Cross where uncooked rations consisting of corn, beans, rice, flour, coffee, and for a time sugar and lard were issued. The peak of distribution was reached about April 30 when some 20,000 persons were fed. From then on the number of ration cards were cut weekly until May 15, when the issue of food was stopped entirely, except to the very needy. In addition to the food distributing centers the Red Cross established two stations where women with babies could obtain fresh milk. In order to stimulate business conditions, the greater part of the food was purchased in Nicaragua. To prevent profiteering and to stabilize prices, a local dealer was permitted to sell articles of food, supplied by the Red Cross, at a nominal profit. This procedure was very successful.

For the relief of the unemployment situation the clearing of the debris from the streets was taken in hand by the Red Cross and shortly an average of 1,000 men with trucks and bull carts were at work daily. A large portion of the material removed was used in much-needed repair work on roads leading out of the city.

Without the generous relief given by the American Red Cross it is difficult to see how the disaster stricken people of Managua would ever have been able to solve the many problems which confronted them.

Although the various emergency water supplies for the city were chlorinated it was felt advisable to inoculate against typhoid as large a proportion of the population as possible. This work was begun on April 3 and vaccination stations in the four district headquarters were established, but after two days it was found that this method was impracticable owing to the difficulty in getting the people to come voluntarily for vaccination. On April 6 and 7 twelve additional stations were established, each in charge of a United States Navy pharmacist mate assisted by a native Hospital Corps man. The food and milk lines afforded excellent places for this work. Each person vaccinated was marked on the chest with a red cross using mercurochrome solution as, in order to avoid repetition, it was only necessary for the mark to be visible for two days. By this method about 12,000 persons were given the first injection. As large numbers had left the city following the earthquake this represented a fairly large proportion of the population. The same methods of vaccination were carried out for the second and third injections. It is realized that some probably received only one dose and others two, but as practically the same persons were in line each day to receive food and milk it is believed that a large percentage of those vaccinated received the full course. After completing this intensive vaccination the four district headquarters were supplied with sufficient vaccine to complete the full course for all people who reported for this purpose. Part of the vaccine used for the first injection was on hand in the brigade and guardia hospitals. Naval ships in the vicinity, the units from Coco Solo, the *Lexington* and *Saratoga* supplied the remainder. The vaccine for the second injection was supplied by the American Red Cross, arriving by plane from Philadelphia. For the third dose the vaccine was purchased by the Nicaraguan Government through the Rockefeller Foundation.

The U. S. S. *Relief* arrived in Corinto April 4. After taking on board all the sick and injured service personnel she put ashore a large quantity of medical supplies. These were placed in storage and were available for use at any time. The sense of security which the presence of these stores gave was beyond words, and it was due to the efforts of Admiral Arthur St. Clair Smith, United States Navy, commander of the Special Service Squadron; Capt. C. W. O. Bunker, Medical Corps, United States Navy, senior medical officer of the U. S. S. *Relief*; and Commander D. C. Walton, Medical Corps, United States Navy, squadron medical officer, that we had this security. These officers visited Managua, and the entire situation was gone over very thoroughly with them. The fullest cooperation was given the medical officers in Managua by the commanding officer and staff of both the brigade and guardia.

At the time of the writing of this article six weeks have elapsed since the earthquake. During this period there have been no epidemics, and it is believed this danger is now over. Conditions are slowly improving. The people are gradually returning, although the housing situation for the poorer classes still leaves much to be desired, especially as the rainy season has now started.

Dr. Victor Ramon has recently been appointed Minister of Health in the President's Cabinet, and it is believed that under his supervision and with the able assistance of Dr. Jacinto Perez sanitary conditions in Managua will steadily improve.

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#### MORTALITY IN APPENDICITIS

By G. F. COTTLE, Captain, Medical Corps, United States Navy

Recently at the naval hospital, Washington, D. C., two patients died following operations for acute appendicitis. These deaths led us to review the mortality in this disease. During the past eight years the writer has been responsible for the surgery in three naval units—the naval hospital, Brooklyn, N. Y., the hospital ship, U. S. S. *Relief*, the naval hospital, Washington, D. C. In that period he and his associates in surgery have performed 800 appendectomies. Of these there were 439 chronic and 361 acute cases. Of the chronic cases one died. Of the acute cases 7 died. Appendicitis acute here includes all stages of appendicitis; those with local inflammation, those with localized peritonitis, those with gangrene, rupture, abscess, spreading and generalized peritonitis. No attempt has been made to differentiate one of these acute varieties from the other. As all appendix cases operated upon during the eight years are included, the review represents, perhaps, a fair cross-section of appendicitis as it occurs in naval hospitals. The rather sketchy comments herein recorded, together with a brief abstract of the case histories in the seven deaths in the acute group, may be of aid to other naval surgeons who are interested not only in the problem of appendicitis but particularly in the problem of further reduction of the mortality from this disease.

If we tabulate these cases with the secondary causes of death and compare the result with the record of the Navy as a whole, as seen in the Annual Report of the Surgeon General, we find:

TABLE 1  
EIGHT-YEAR PERIOD, THREE NAVAL SERVICES, 1923-1931

	Operations	Deaths	Mortality
Chronic cases.....	439	1	<i>Per cent</i> 0.2
Acute cases.....	361	7	1.1
Total.....	800	8	1

TEN-YEAR PERIOD, ALL NAVY, 1920-1929

	Operations	Deaths	Mortality
Chronic cases.....	4,329	9	<i>Per cent</i> 0.2
Acute cases.....	7,875	116	1.4
Total.....	12,204	125	1

TABLE 2.—*Secondary causes of death*

	Chronic cases	Acute cases
Three naval services:		
Peritonitis, ileus.....	1	7
All navy:		
Peritonitis and ileus.....	5	72
Pneumonia, lobar.....	1	5
Heart.....	2	2
Embolism.....	1	4
Pneumonia, broncho.....	0	4
Abscess of liver.....	0	2
Septicemia.....	0	1
Status lymphaticus.....	0	1
Anesthesia.....	0	5
Cause not recorded.....	0	20

The causes of mortality commonly reported in the literature are: (1) Catharsis; (2) delay by the patient; (3) delay by the doctor.

Seldom or never is the surgeon accused of delay. This report finds him sharing with others in the responsibility. There seems to be no argument in favor of giving cathartics in the presence of abdominal pain except when appendicitis as the cause of the pain can be satisfactorily and conclusively ruled out. Abdominal pain in the right iliac fossa is the most constant symptom. It is recorded present in about 95 per cent of all cases of appendicitis acute. It is preceded by general abdominal pain in about 75 per cent of all cases. As intestinal splinting is nature's only defense against the complications of the disease, to withhold catharsis in the presence of history of abdominal pain should be a rule with few or no exceptions. Yet, it is a rule not infrequently disobeyed. Statistics all over the world in thousands of cases operated upon by surgeons of varying ability and experience indicate that operation in acute appendicitis in the first or second day of the disease, that is before

the stage of abscess or spreading peritonitis, is practically devoid of mortality. If all persons who have a pain in the right iliac fossa knew and believed these figures, few would delay in seeking the advice of the surgeon.

It is not likely that the patient, the doctor, or the surgeon deliberately delay in making a diagnosis of acute appendicitis or in presenting the case for operation. There must be some good reason for these delays. Some of the reasons for delay are:

1. Difficulty in diagnosis in certain cases.
2. The dangerous and abandoned slogan, "Wait for the interval."
3. The knowledge that medical treatment not infrequently will bring about a subsidence of the acute attack.
4. The teaching of Ochsner applied to the wrong case. The non-operative Ochsner treatment for generalized peritonitis late in its course may reduce the mortality of this grave complication. Its principles do not apply to appendicitis itself. They apply only to that most lethal complication, generalized peritonitis.

TABLE 3.—*The seven acute cases*

Case	Age	Day of disease	Incision	Location	Pathology	Drain	Post-operative day of death	Cause of death
1	21	2	McBurney.....	.....	Abscess.....	1	11	Enterostomy and appendectomy, ileus. Gangrene, 14 inches of terminal ileum.
2	47	4	Right rectus...	Pelvis...	Gangrene, rupture pelvic abscess.	3	4	Ileus, adhesions 2 feet from ileocecal valve. Walled off abscess.
3	32	4	.....do.....	.....do.....	Gangrene, generalized peritonitis.	2	2	Generalized peritonitis.
4	24	14	McBurney.....	.....do.....	Gangrene, plastic pelvis, peritonitis.	0	8	Enterostomy, kink in ileum, ileus.
5	17	2	.....do.....	.....do.....	Gangrene, rupture	0	9	Ileus, enterostomy.
6	23	7	Right rectus...	.....do.....	Generalized peritonitis to death on table.	.....	.....	Gangrene and rupture, generalized peritonitis.
7	29	12	.....do.....	.....do.....	Ruptured appendix, pelvic abscess.	0	6	Ileus, miliary tuberculosis, generalized peritonitis.

#### CASE REPORTS

**CASE 1.**—J. R. L., apprentice seaman, United States Navy, age 21 years; naval hospital, Brooklyn, N. Y. For two months he had had occasional pain in abdomen but thought it would "work off." While his ship was en route to New York the pain became more severe. After two days of pain he reported to his medical officer. The abdomen showed a generalized rigidity and a McBurney incision was made and an abscess drained, appendix not removed. When the ship reached New York he was transferred to the hospital on his fourth postoperative day. On the eleventh postoperative day distention could not be relieved. Enterostomy was done and the appendix removed but death ensued. Autopsy showed distended gut above an area of gangrene of the ileum involving the last fourteen inches and evidence of a generalized peritonitis.

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**CASE 2.**—W. F. F., boatswain, United States Navy, age 47 years; U. S. S. *Relief*. Under way at sea he suffered for two days from abdominal pain. For this he took castor oil, olive oil, and lemonade. On the second day the pain became intense and the doctor who first saw him stated that he was in of state of semicollapse with extreme abdominal rigidity and sweating. He was transferred to the hospital ship and not operated upon until the fourth day of the disease when he again had a severe pain and weakness similar to the first attack. Operation—right rectus—a perforated, gangrenous appendix was removed from a large pelvic abscess, the appendix was in the pelvis. Three Penrose drains were inserted. On the fourth postoperative day, after an interval of improvement, he became distended; pulse rose from 76 to 120 and death ensued. Autopsy showed a walled off abscess in region of the cecum and pelvic adhesions about two feet from the ileocecal valve caused the obstruction. The gall bladder contained 59 stones.

**CASE 3.**—C. B. S., fireman, second class, United States Navy; 33 years of age; U. S. S. *Relief*. For four days he continued to stand the watches on a destroyer at sea with the fleet, suffering from abdominal pain. In the afternoon of the fourth day he was too sick to go on. The division medical officer was sent for. When the doctor first saw him his knees were drawn up under his chin, the abdomen was board-like, there was pain in the left lower quadrant and profuse sweating. Transferred at sea to the hospital ship. His diagnosis was changed to generalized peritonitis and operation decided upon. Through right rectus incision a gangrenous appendix was removed from the pelvis. Preoperative pulse was 140. Two Penrose drains inserted. He died on the second postoperative day in coma. Autopsy showed a wide-spread purulent peritonitis, pus everywhere even as high as the liver.

**CASE 4.**—H. H. B., water tender, second class, United States Navy, 24 years; U. S. S. *Relief*. For one month he had had mild attacks of pain in the right lower quadrant, occasional nausea, and rise in temperature. Upon admission to the hospital ship he was studied for two weeks, even with a barium gastrointestinal X-ray series. A tonsillectomy was done. One week after the tonsillectomy he felt faint, had severe abdominal pain, profuse sweating, and it was noted that the abdomen was distended. Operation—McBurney—an acutely inflamed and gangrenous appendix was removed from a pelvic position where a plastic peritonitis was present. For eight days his course was smooth when abdominal distention recurred. Enterostomy (Witzel) in the distended bowel above a definite kink, which was removed, failed to save him. He died the next day.

**CASE 5.**—J. W. G., apprentice seaman, United States Navy, 17 years; U. S. S. *Relief*. Serving on board a destroyer, cruising at sea with the fleet, he had continued on duty for several days after his abdominal pain began. Two days before the doctor was sent for, he had been worse. While standing watch the day of his admission to the sick list, he was seized with vomiting and cramps and the pain became localized in the right lower quadrant. The medical officer who first saw him noted that the abdomen was tender and hard. After his transfer to the hospital ship his temperature was 102°, pulse 121. Operation on the third day of his acute attack permitted removal of a gangrenous, ruptured appendix from a lake of opaque purulent exudate in the region of the iliac vessels. After a smooth postoperative course for about five days, he became distended and on the ninth postoperative day enterostomy was done on a distended loop of small intestine. Autopsy showed a greatly distended small intestine and generalized peritonitis.

**CASE 6.**—E. W. J., private, United States Marine Corps, age 23; naval hospital, Washington, D. C. On admission pulse was 160, respiration 60, tem-

temperature 102°, abdomen distended. He had been ill for a week. The afternoon before admission he suddenly became much worse, pain increased, there was weakness and profuse sweating. On admission a consultation was held to discuss Ochsner expectant treatment versus operation. It was decided that operation was justifiable in the hope that the causative pathology might be a perforated duodenal ulcer. Under spinal anesthesia the abdomen was opened through a high right rectus incision, pus welled down in large amount from the dome of the liver and from the left side. Before the duodenum could be properly visualized, death suddenly occurred on the operating table. Autopsy revealed a ruptured gangrenous appendix lying in the pelvis and a purulent generalized peritonitis as high as the spleen.

CASE 7.—C. P. M., radioman, first class, United States Navy, age 28 years; naval hospital, Washington, D. C. For six months he had a chronic cough with considerable expectoration, had lost eight pounds, and felt "run down." Two days prior to admission he was seized with a severe pain in the abdomen and felt faint. On admission to the hospital he had a fever and rapid pulse. Study demonstrated active pulmonary tuberculosis with cavitation in one apex and positive sputum. Although diagnosed undetermined (acute appendicitis), he was not operated upon for 10 days during which period he was observed by the surgeons and others of the hospital staff. On the twelfth day of his illness operation was decided upon. Through a right rectus incision a ruptured appendix was removed from the pelvis, where it lay in a large pelvic abscess. The cecum showed a granular peritoneal surface. Until the sixth postoperative day the abdominal condition was satisfactory. Abdominal distention then became marked. Broncho-pneumonia was diagnosed and death ensued. Autopsy showed millary tuberculosis of lungs and intestines and a generalized purulent peritonitis with ileus.

A study of the medical histories of the seven deaths in this series of cases has given certain findings and has led to a few conclusions.

Delay prior to operation, and the pelvic position of the appendix seem to be the common characteristics in these fatal cases. The sea-going environment, the doctor, and the surgeon each seem to have a share in the responsibility. It would seem that, perhaps, it is the pelvic position of the appendix which causes delay. Perhaps the dangers of delay are greater if not more common in persons who happen to have their appendices located in the pelvis. In this type of case the symptoms do not always follow the Murphy diagnostic picture: First, general abdominal pain; second, nausea; third, localization at McBurney's point; fourth, fever.

If we study a large number of case histories of acute appendicitis many variations from the typical will be found. Tormina is absent in about 25 per cent. Nausea and vomiting in a fair number of cases is absent. Pain localizing at McBurney's point though the most constant symptom (95 per cent) is, unfortunately, a symptom of other pathology as well. Rigidity and tenderness may not be found and are not infrequently absent or difficult to elicit with certainty, especially when the appendix is not near the parietal peritoneum—when it is retrocecal or behind the mesentery or in

the pelvis among the coils of the small intestines or walled off by the great omentum.

Fever is not often above  $99^{\circ}$  or  $100^{\circ}$  in appendicitis. It may be  $102^{\circ}$  or more, or normal in pelvic abscess. It may be for a brief interval subnormal in the early stage of rupture, gangrene, or the beginning of a generalized peritonitis.

Leucocytosis and a "shift to the right" in the differential count is a help when present. A normal blood cell count, however, does not rule out gangrene, rupture, pelvic abscess, or generalized peritonitis.

The pulse is the most valuable single index of peritonitis provided no other cause for a pulse rapid in proportion to the degree of the fever is present. In localized peritonitis the pulse is typically 80-90, it soon rises to 110 or 120 as the peritonitis spreads. When it reaches 130 or more, death from generalized peritonitis is not far off.

In the pelvic appendix case the unfolding of the symptoms is so atypical that often appendicitis is not diagnosed until operation or autopsy reveals the true pathology. A review of the seven cases brings out the following clinical picture in these pelvic cases.

After a period of generalized abdominal pain there is little or no tendency to localization. The acuteness of the patient's attack subsides. For a day or so he seems to get better. There may be some frequency of urination, some difficulty in evacuation of the bowels. He does not appear very ill. There may be a little residual abdominal fullness or distention. Tenderness and rigidity do not seem to be present. The temperature may be up to  $102^{\circ}$  or it may be nearly normal. The pulse may be down to 72. It does not seem to patient or doctor that appendicitis can be the cause of the trouble. The vigilance of the doctor or surgeon is relaxed, the patient is permitted to take nourishment, a cathartic or an enema may be given. He may be permitted to get out of bed. Suddenly on the third or fourth or a later day of his apparently slight illness something happens. There is a sinking spell or partial collapse with sweating and perhaps nausea. The pelvic abscess until now confined within soft plastic adhesions has burst its bounds. It spreads up to the left or the right gutter. After the sweating there is a brief interval of improvement, then he begins to look ill, distention increases, the pulse rises, the rectal examining finger may or may not find a degree of tenderness in the pelvis, soon generalized peritonitis with its soft, silent, distended abdomen is evident, the pulse continues to rise, the facies are pinched, great restlessness occurs, the pulse goes to 140 then disappears, and death ensues.

The lesson to be learned from appendices in the pelvis is that, though rare, they are apt to be lethal because not diagnosed early. It may be that early and more frequent use of digital exami-



nation of the rectum and a knowledge of the atypical symptoms and course of the cases, may save lives by bringing operation to these people at an earlier stage.

Ileus is frequent in the terminal stage of these lethal cases. The operation is followed by improvement for a day or so then distention of the abdomen either fails to disappear or it recurs, enemata fail to relieve. The distention increases, vomiting recurs and persists in spite of gastric lavage. The pulse rises again. There may be a brief period of colicky pain or there may be no pain. After a few hours the distended abdomen becomes quiet, the character of the vomiting becomes intestinal. Enterostomy may be decided upon, generally as a last resort, and usually without success. I think we need not fear death from peritoneal infection but rather from the intestinal obstruction which results. While it is true that occasionally the patient is overwhelmed by the toxic products of the inflammation, in most cases the peritoneum is able to combat and neutralize the infection. If the patient with a wide-spread peritonitis lives a few days the pus becomes sterile, lying more or less inert and harmless in contact with the intestines. When the coils of the intestine become matted together or adhesions cause kinks or bands that obstruct the peristaltic flow, the patient is threatened with death due to the intestinal obstruction.

In this state unless enterostomy or some other quite drastic measure brings relief, reverse peristalsis, dehydration, toxemia and death ensue. Perhaps, if in these postoperative distention cases we relied less on pituitary extract and enemata and performed a high enterostomy earlier, more of these cases might be saved.

The manner in which the coils of the small intestine are handled at the time of operation for removal of an acute appendix is most important. The less handling the less the danger of intestinal obstruction from adhesions. The McBurney incision, though condemned by many because of the limited exposure, has this distinct advantage. It tends to keep the operator away from the coils of the ileum. Monyihan stresses the great importance of this attitude of extreme gentleness and no interference with the ileum. He advocates the right rectus incision in his book and stresses need for "the utmost gentleness"; again he speaks of "infinite gentleness" and adds in this attack on the inflamed coil of intestine "there is no need for display,"—roughness and haste may result in disaster.

The question of drainage is important. We drain very seldom after appendectomy—as a rule, only when an abscess with ragged walls is present. The appendiceal abscess from which the operator does not or can not readily remove the appendix should be drained. The pelvic abscess or generalized peritonitis probably is not greatly

benefitted by drainage. We have had abscesses form in drained cases with the drain in place and have seen general peritonitis recover without the use of drains. Drains favor intestinal obstruction, they increase the liability to kinks and bands. The glass tube and stiff rubber tube are believed to be a not uncommon cause of an intestinal fistula. Drains predispose to incisional hernia. Seldom do they adequately and completely drain. When used they should be placed in contact with the parietal peritoneum and not in contact with the coils of the small intestine. A drain to the appendiceal stump, withdrawn within 48 hours, seldom does any harm, but we believe it is seldom necessary. We use a drain when the cecum is indurated and possibly necrotic. We believe in the dictum of Blake stated over 20 years ago, "The peritoneum can handle infection, the peritoneum can handle a foreign body. The peritoneum will have a struggle to handle both infection and a foreign body."

In conclusion it may be stated that: Acute appendicitis operated upon before the stage of abscess and generalized peritonitis is practically devoid of mortality. After 48 hours from onset the mortality rises.

Every abdominal pain should be considered appendicitis until proven to be due to other pathology.

A rising pulse generally means peritonitis in cases which begin with abdominal pain.

The decision for or against operation should be made after a brief (2 to 3 hours) period of intensive study of the case.

Operation should be offered as soon as the diagnosis is made and usually when acute appendicitis can not be conclusively ruled out.

The Ochsner treatment should not be used in appendicitis. It is advocated only for cases of generalized peritonitis—pulse over 130 and a silent distended abdomen.

The pelvic appendix with its atypical onset and course must be remembered, bladder and rectal symptoms associated with abdominal pain given careful consideration, and the rectal examining finger not forgotten.

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### THE SIGNIFICANCE OF THE LEUKOPENIAS<sup>1</sup>

WITH SPECIAL REFERENCE TO AGRANULOCYTOSIS

By R. R. KRACKE, Lieutenant (J. G.,) Medical Corps, United States Naval Reserve

During past years it has been customary to think of a diminished number of white blood cells as a matter only of theoretical interest,

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or as an aid in diagnosis in various infectious diseases that we know to be accompanied by a leukopenia. It has always been regarded as an end result of certain types of infections, with the assumption that the bone marrow responds either in an atypical fashion to an infectious agent or that the circulating white cells are destroyed by the infection. Because of this acceptance of dogmatic principles and apathetic attitude toward leukopenias in general, we find that the subject has not received the attention that it deserves. This was especially true before our knowledge of agranulocytosis, but since this disease has made its appearance, the subject has assumed considerable importance.

When agranulocytosis was first described it was thought that the disappearance of the circulating leukocytes was probably due to a peculiar action of bacterial toxins, or that bone marrow became non-functional because of the paralytic action of bacteria of unknown types. Much work has accumulated, however, to show that the essential pathological process in that disease is primary in the bone marrow, and that the infection is a subsequent and oftentimes a terminal event.

With this knowledge has come a new conception of the significance of the leukopenias, and whereas we formerly regarded them as diagnostic aids only, we now see that a decrease or absence of white blood cells can be attended and followed by the most serious clinical conditions. As to be expected, when the powerful daily conferred immunity of the leukocytes is diminished because of a diminished number of cells, the resistance of the individual falls to a correspondingly low ebb, so that bacterial invasion may be expected from those parts of the body that are normally inhabited by bacteria.

Considerable evidence has accumulated to indicate that a loss of the circulating granular cells for a period of only a few days is incompatible with life, regardless of whether or not infection is present. As an example:

**CASE 1.**—A strong, healthy man for two or three days felt tired and worn out. He had no pain, the pulse rate was slightly increased, the temperature markedly elevated. He went to bed because of extreme weakness and exhaustion. Physical examination revealed nothing of importance. X-ray examination offered no aid. The red cell count was normal, the hemoglobin normal, the white cell count about 500, with complete absence of granular leukocytes. He slowly passed into coma and death ensued in 48 to 72 hours. Autopsy revealed nothing except a pathological bone marrow that was devoid of granular leukocytes and their precursors.

Such a patient the writer has observed in a series of nine cases of agranulocytosis, and there is no conclusion that can be drawn except that this individual died from a mere absence of granular leukocytes.

When we have such evidence to indicate that the loss of the granulocytes is incompatible with life, the subject assumes real and practical importance.

Roberts and the author (1) have been able to demonstrate that the local and general infection that most often accompanies the disease is a process subsequent to the development of the bone marrow pathology. Most cases of agranulocytosis do not reveal the acute fulminant attack, the patient dying from a mere absence of leukocytes, as shown by the case described. They may live for days or even weeks, thus allowing time for the development of infection, so that when the patient presents himself to the physician, he is perhaps in the third stage of the disease. The clinical picture, therefore, will be largely that of sepsis, consisting of high fever, increased pulse rate, perhaps blood stream infection, ulcerations in the oral cavity, and prostration. At that time bacteria may be circulating in the blood stream. Hence, the true pathology of the disease at that time or at autopsy is frequently obscured by the evidences of infection.

There often exists many variations of the above picture. Many cases show no oral ulcers, and for this reason the name agranulocytosis is more fitting than agranulocytic angina. Blood cultures may be negative. Bacterial invasion may be restricted to a few organisms of comparatively little pathogenicity. These factors are in a large measure dependent upon the degree of diminution in the number of granulocytes. The white cell count may hover about 1,500, resulting in a mild degree of infection or a constant stimulation of the bone marrow by the infection itself, and hence, a prolonged clinical course. Such cases may seem to recover completely and then later have a second and third attack after varying periods of time. The usual remission period varies, but ranges between one and three months. Or, there may be a permanent cure, but this is rare. This type of case may be illustrated by the following:

CASE 2.—A previously healthy woman of 72 years suddenly developed a sore throat with numerous small ulcerations of the gums and buccal mucous membranes. When first seen by a physician, her temperature was 103° F., her pulse rate increased, and she exhibited an unusual degree of prostration. Physical examination was entirely negative except for the throat findings. She was extremely weak, listless, and prostrated, and almost comatose. The red cell count was normal, the white cell count 800 with no granulocytes. She gradually grew worse with the white cell count decreasing; remained in coma for three days, during which time hemolytic streptococci were isolated from her blood, urine, stools, mouth ulcers, and also from incised embolic abscesses. She suddenly took a turn for the better; the white cell count rose to 40,000 in four days. She then made a slow but uneventful recovery.

At about the time when she was to return home, two months later, the white cell count fell from a low level of 5,000 to 2,000 with the granular cells again absent. This was present for four days when she suddenly became profoundly

weak, took to bed, lapsed into coma, and died within two days, showing no evidence of infection.

This case illustrates the recurring type, the first attack being characterized by widespread infection with hemolytic streptococci. This infection was probably responsible for a renewed activity of a previously paralyzed bone marrow, and thus aided in her recovery. In the second attack no evidence of infection was present.

The typical picture of agranulocytosis, as first described by Schultz (2) includes infectious processes as a dominant feature, the diagnosis, however, being dependent upon the marked decrease in the number of granulocytes. His cases died in the first attack in a manner that could be aptly described as a septic death. From the writer's series a description is given of the typical acute, fulminant first attack with infection.

**CASE 3.**—A physician, aged 50, had for some months felt weak, tired, and exhausted, especially after exertion of a mild nature. Before that time he was in splendid health. Within a period of two days he became acutely ill with sore throat, mouth ulcers, elevated temperature, increased pulse rate and prostration. The diagnosis was influenza or septic sore throat. The white cell count was below 1,000 with no granulocytes.

He was admitted to the hospital, was given transfusions, X-ray therapy, and supportive treatment, and on the fourth day was in coma with pneumococci in the blood stream, and the white cell count about 500. He died on the sixth day with the clinical picture being that of widespread infection in the mouth, gums, blood stream, lungs (as evidenced by a terminal broncho-pneumonia), and multiple embolic abscesses.

#### GRANULOCYTOPENIA

Agranulocytosis as discussed above, in which the white cell count falls below 1,000 with complete absence of granulocytes, and an acute attack that usually terminates fatally, probably represents the extreme reduction of granular cells. It is reasonable to assume that if there has arisen in modern times a disease of that nature, there will also be cases of a milder degree, the severity of which would be dependent upon the amount and rate of decrease of the white cells.

The term "granulocytopenia," which perhaps more fittingly could be shortened to granulopenia, is used to express that condition which is characterized by a decreased number of granulocytes, and includes agranulocytosis as the extreme state. The term has the further virtue of being consistent with the terminology applied to reductions in white cells, as proposed by Boener (3), which is given below:

**Leukopenia**, a decrease in all leukocytes.

**Neutropenia**, a decrease in neutrophils.

**Basopenia**, a decrease in basophiles.

**Eosinopenia**, a decrease in eosinophiles.

**Monopenia**, a decrease in monocytes.

**Lymphopenia**, a decrease in lymphocytes.

**Granulopenia**, a decrease in granulocytes.

**Thrombopenia**, a decrease in thrombocytes.

Acute and chronic granulopenia and the resulting clinical syndromes have been recently described by Roberts and the author (4). The granulopenias may be divided into the acute and chronic types, or there may exist a chronic type in which the white cell count hovers around 5,000 with 50 per cent or less neutrophiles, with acute attacks at irregular intervals. We studied the records of 8,000 private patients and found that the typical granulopenic patients are women between the ages of 40 and 60, and that they seem to have a fairly definite clinical syndrome which is characterized mainly by weakness, a tendency to easy fatigue, and exhaustion. This may result or be accompanied by a train of variable nervous symptoms.

It is such a patient that is likely to be a victim of the more acute attacks of granulopenia, these attacks varying from a mild, transient period of symptoms to agranulocytosis. The attack of acute granulopenia seems to come on suddenly and is characterized by an unusual feeling of fatigue, sleepiness, and malaise, with a slightly increased temperature and pulse rate. During this time, the resistance is lowered and mouth ulcers may appear. The occurrence of the mouth ulcers seems to stimulate the bone marrow, this resulting in a normal cell count and recovery.

In the few recorded instances of blood counts being done prior to an attack of agranulocytosis, it has been found to be a low level for normal, indicating that these patients may have periods of chronic granulopenia of months or years.

The significance of the leukopenias may be more important than we suspect even at this time when we consider that the presence of that obscure quality, known as immunity, may, to a large degree, be dependent upon the number of circulating granulocytes.

#### THROMBOPENIC AGRANULOCYTOSIS

When Schultz (2) first described agranulocytosis as a clinical entity, he described a condition in which none of the blood constituents were affected except the white cells. If his original criteria are adhered to, then many cases reported as agranulocytosis would be excluded because of the accompanying hemorrhagic diathesis. This seems to be always due to a diminished number of blood platelets. The clinical picture in the forefront is that of purpura and hemorrhages, so that granulopenia is oftentimes lightly considered.

Cases of agranulocytosis with the hemorrhagic diathesis are being reported more frequently, and is evidence that whatever the cause of the myeloblastic dysfunction, the same cause affects the thromboclastic tissues in some cases. Therefore, there can be no hard and fast line drawn between the two conditions. It is also true that the same toxin, as to be expected, will not infrequently affect the

erythroblastic tissues. If this happens, we may then have a condition simulating aplastic anemia. Since it is generally accepted that all three elements have their origin in the bone marrow, it is reasonable to assume that the agent responsible for myeloblastic dysfunction may or may not affect the other two, so that all types of dyscrasias may result, with their related, but yet different, clinical pictures.

In agranulocytosis that is complicated by purpura and hemorrhages, it is important that the condition be recognized as such and not confused with that disease known as simple idiopathic purpura hemorrhagica, which apparently has its origin, not in the bone marrow, but in the spleen, although this point has not been settled.

The practical importance in this differentiation becomes manifest when it is considered that splenectomy is a valuable therapeutic procedure in idiopathic purpura hemorrhagica, but obviously would be of no value but actual harm in thrombopenic agranulocytosis. It may be that the failure of splenectomy in some cases diagnosed as purpura hemorrhagica might be explained on this basis, since the essential pathology would have been a bone marrow dysfunction.

The granulopenia then becomes of real diagnostic importance in the differentiation of the two conditions. The importance of the granulopenia in this type of case is well illustrated by Bamforth and Elkington's (5) recent report of four cases of arsenobenzol purpura, all showing a marked decrease in platelets with associated purpura and hemorrhages, but two showed a marked granulopenia, and could well be named thrombopenic agranulocytosis. These two died and the others recovered, although there were no differences in the extent of platelet involvement and degree of hemorrhages.

The writer (6) described this condition as agranulothrombopenic purpura, though the term thrombopenic agranulocytosis might be more correct.

Recently, while on duty at the United States Naval Medical School, Washington, D. C., I had the privilege of studying a patient who had a diagnosis of purpura hemorrhagica because of the marked hemorrhagic diatheses, lowered platelets, moderate anemia, and leukopenia. A splenectomy was done with no benefit, because it was obvious later that the essential pathology was in the bone marrow. The record of the blood findings in this case, with additional comments, follows:

CASE 4.—White male, age 35 years, weight 151 pounds, height 67½ inches. History negative prior to January 15, 1931, when he had an attack of influenza. Was in bed three days. During and following this attack noticed blood oozing from gums and would awaken in morning with mouth full of blood. During this time has been very weak. Fatigues easily with exertion. Blood count: Red blood cells 2.8; hemoglobin, 65.

Admitted to hospital January 31, 1931. Family and past history essentially negative.

Physical examination: Acutely ill, extremely pale. Hemorrhagic areas on the left tonsil and gums, both thighs, left buttock, back, and anus. Otherwise negative.

Laboratory findings: Kahn negative, stools positive for occult blood, sputum negative, blood chemistry negative, gastric analysis 15 total acidity, no free HCL. Several carious teeth.

Summary of findings: (1) Anemia, (2) palpable cervical glands, (3) hemorrhages skin and mucous membrane, (4) occult blood in stool and gastric contents, (5) achlorhydria, (6) carious teeth, (7) positive tourniquet test, (8) recent influenza, (9) use of Fowler's solution of a mouth spray for Vincent's angina infection about a year ago.

Treatment: (1) Rest in bed, (2) anemia diet, (3) liver extract, (4) removal of foci of infection, (5) blood transfusions.

*Blood findings—case 4*

Date	Red blood cells (million)	White blood cells (thousand)	Hemoglobin (per cent)	Platelets	Reticulocytes	Granulocytes	Lymphocytes	Mono-cytes	Miscellaneous tests and remarks
Jan. 31, 1931	2.5	3.5	51	-----	-----	43	48	9	Coagulation time 3 minutes, 25 seconds; fragility test 0.40-0.32 per cent. Negative malaria.
Feb. 3, 1931	2.7	-----	51	-----	5.0	-----	-----	-----	
Feb. 9, 1931	2.9	3.5	63	-----	7.8	49	47	4	
Feb. 12, 1931	2.5	-----	-----	-----	9.4	-----	-----	-----	
Feb. 16, 1931	2.2	-----	49	-----	5.4	-----	-----	-----	
Feb. 18, 1931	2.1	-----	45	-----	3.9	-----	-----	-----	
Feb. 20, 1931	-----	-----	44	33,600	-----	-----	-----	-----	Coagulation time 3 minutes; bleeding time incomplete 20 minutes.
Feb. 25, 1931	2.0	-----	48	-----	2.6	-----	-----	-----	
Feb. 26, 1931	2.0	-----	48	-----	2.5	-----	-----	-----	
Feb. 27, 1931	2.0	-----	48	-----	2.2	-----	-----	-----	Blood transfusion.
Feb. 28, 1931	2.4	-----	56	-----	2.7	-----	-----	-----	
Mar. 2, 1931	2.5	-----	62	-----	1.9	-----	-----	-----	
Mar. 3, 1931	2.4	-----	63	-----	1.7	-----	-----	-----	
Mar. 4, 1931	2.5	-----	59	-----	2.0	-----	-----	-----	
Mar. 5, 1931	2.3	-----	53	-----	2.0	-----	-----	-----	
Mar. 6, 1931	2.2	-----	52	-----	1.2	-----	-----	-----	Do.
Mar. 7, 1931	2.8	-----	56	-----	1.5	-----	-----	-----	Bleeding continues.
Mar. 9, 1931	2.8	-----	61	-----	1.0	-----	-----	-----	
Mar. 10, 1931	2.4	-----	53	-----	.9	-----	-----	-----	
Mar. 11, 1931	2.4	-----	53	-----	.6	-----	-----	-----	
Mar. 12, 1931	2.4	3.4	50	35,000	-----	44	54	2	Blood transfusion.
Mar. 16, 1931	2.4	3.2	54	42,160	-----	-----	-----	-----	
Mar. 17, 1931	2.4	3.4	54	44,000	-----	44	54	2	Diagnosis changed to purpura hemorrhagica.
Mar. 18, 1931	2.2	2.2	46	33,300	-----	-----	-----	-----	
Mar. 20, 1931	2.3	2.7	46	26,600	.4	35	62	3	
Mar. 23, 1931	2.3	2.4	45	29,000	.4	-----	-----	-----	
Mar. 25, 1931	2.0	2.7	40	24,000	.2	-----	-----	-----	Blood transfusion.
Mar. 27, 1931	2.7	3.7	51	48,780	1.2	-----	-----	-----	
Mar. 30, 1931	2.3	2.0	48	30,680	.5	-----	-----	-----	Bleeding continues.
Apr. 1, 1931	1.9	2.7	42	11,480	.2	34	55	11	Blood transfusion. Bone marrow biopsy. Shows absence of myelocytes and megakaryocytes. Red blood cells normal.
Apr. 6, 1931	2.0	2.6	40	18,270	1.1	36	61	3	Bleeding continues.
Apr. 7, 1931	2.7	-----	52	42,000	-----	-----	-----	-----	Blood transfusion. Splenectomy.
Apr. 8, 1931	2.6	-----	48	61,000	-----	-----	-----	-----	
Apr. 9, 1931	2.2	2.5	48	49,600	-----	66	24	10	
Apr. 10, 1931	2.1	2.9	41	63,000	2.5	62	26	12	
Apr. 11, 1931	2.1	2.6	43	103,000	1.6	61	33	6	Blood transfusion.
Apr. 13, 1931	2.2	-----	46	96,750	2.4	-----	-----	-----	



*Blood findings—case 4—Continued*

Date	Red blood cells (thousand)	White blood cells (thousand)	Hemoglobin (per cent)	Platelets	Reticulocytes	Granulocytes	Lymphocytes	Monocytes	Miscellaneous tests and remarks
Apr. 14, 1931	2.6	-----	52	125,000	2.2	-----	-----	-----	Blood transfusion.
Apr. 15, 1931	2.5	3.9	52	127,000	2.0	64	30	6	
Apr. 16, 1931	2.5	-----	52	159,000	2.0	-----	-----	-----	Do.
Apr. 17, 1931	3.2	-----	65	185,320	2.8	-----	-----	-----	
Apr. 18, 1931	3.1	-----	69	171,000	1.8	-----	-----	-----	
Apr. 20, 1931	4.0	4.3	76	171,000	.8	52	38	10	Uneventful recovery from splenectomy. No bleeding since splenectomy.
Apr. 21, 1931	3.9	-----	76	149,000	.5	-----	-----	-----	
Apr. 22, 1931	3.9	5.7	76	115,000	.8	-----	-----	-----	
Apr. 23, 1931	3.6	-----	72	98,500	.9	-----	-----	-----	
Apr. 24, 1931	3.1	-----	62	80,000	1.2	-----	-----	-----	
Apr. 25, 1931	4.1	5.7	80	152,000	2.4	-----	-----	-----	
Apr. 27, 1931	4.2	-----	82	122,000	1.9	-----	-----	-----	
Apr. 28, 1931	4.2	5.6	83	144,000	1.4	-----	-----	-----	
Apr. 29, 1931	4.2	-----	83	138,000	1.1	-----	-----	-----	
Apr. 30, 1931	3.9	3.8	80	90,500	1.2	-----	-----	-----	
May 1, 1931	3.5	-----	78	46,670	.8	-----	-----	-----	
May 2, 1931	4.1	-----	80	127,000	2.1	-----	-----	-----	
May 4, 1931	4.2	-----	85	88,620	1.7	-----	-----	-----	
May 5, 1931	3.9	-----	77	55,160	.8	-----	-----	-----	
May 6, 1931	3.7	2.9	75	43,120	1.3	34	62	4	
May 7, 1931	3.6	3.3	74	36,000	1.0	36	62	2	Blood transfusion. Up and about, feeling well, no bleeding.
May 9, 1931	4.0	3.2	81	65,400	-----	22	75	3	
May 11, 1931	4.0	3.5	82	72,500	.9	27	66	7	
May 13, 1931	3.9	4.2	81	98,250	.6	23	72	6	1 per cent irritation form lymphocytes noted.
May 15, 1931	3.9	3.0	80	51,000	.4	26	61	13	
May 18, 1931	3.7	4.5	78	37,200	.5	28	79	3	Slight oozing from gums.
May 20, 1931	3.6	5.1	76	44,000	.6	31	64	5	Blood transfusion.
May 21, 1931	4.1	5.6	83	37,000	-----	34	62	4	
May 22, 1931	4.0	5.8	82	64,000	.7	18	75	7	
May 25, 1931	3.9	5.7	80	47,000	1.2	16	82	2	
May 27, 1931	3.7	6.6	78	31,600	.6	11	86	3	
May 29, 1931	4.2	5.4	84	92,000	1.6	5	93	2	Do.
June 2, 1931	4.1	6.4	80	82,000	1.5	13	82	5	
June 4, 1931	3.9	6.7	79	37,000	.6	9	87	4	
June 5, 1931	3.7	7.4	81	98,600	.9	5	94	1	
June 10, 1931	3.8	6.0	78	54,400	.8	5	88	7	
June 12, 1931	3.4	5.1	68	41,000	.8	8	89	3	Blood transfusion. Continues to bleed.
June 15, 1931	3.8	5.6	76	68,600	1.2	6	91	3	
June 17, 1931	3.9	6.0	79	70,000	.8	2	97	1	
June 19, 1931	3.6	5.9	74	45,000	.5	4	92	4	
June 22, 1931	3.5	5.5	72	42,000	.7	2	97	1	Blood transfusion.
June 24, 1931	3.8	5.7	81	35,440	.7	3	98	4	
June 26, 1931	3.6	4.3	76	37,000	.9	3	96	1	
June 29, 1931	3.6	3.8	72	50,900	.6	4	93	3	Patient worse. Bleeding from gum's. Purpura spots. Temperature 102.
July 11, 1931	3.2	4.2	65	32,000	.5	3	94	3	
July 3, 1931	3.2	3.5	65	40,800	.8	3	95	2	
July 6, 1931	2.9	3.4	58	35,000	.2	4	94	2	
July 8, 1931	2.9	4.4	59	42,200	.3	8	90	2	
July 10, 1931	2.6	3.2	54	21,500	.5	3	92	5	
July 13, 1931	2.9	4.1	58	41,000	.2	4	92	4	Patient grows steadily worse. Bleeding in G. I. & G. U. tracts. Large ulcer in upper right mouth.
July 14, 1931	2.6	3.4	54	31,000	.6	7	89	5	Blood transfusion.
July 20, 1931	1.8	2.5	39	13,500	.4	12	82	6	Blood transfusion. July 17, 1931.
July 24, 1931	1.1	3.2	24	4,560	.3	16	84	2	Blood transfusion. July 21, 1931.
July 27, 1931	.8	3.3	16	-----	-----	12	84	4	
July 30, 1931	.5	3.7	9	-----	-----	-----	-----	-----	Died.

*Pathological diagnosis (autopsy by Dr. Otis Wildman):* 1. Thrombopenic purpura, atypical, idiopathic; 2. granulocytopenia, idiopathic; 3. anemia, semi-aplastic and secondary hemorrhagic; 4. bronchopneumonia; 5. splenectomy.

A close study of this most excellent record of the blood findings in this case will show that when the patient was first admitted to the hospital, the outstanding features were anemia, leukopenia, and purpura, as evidenced by the decreased red cells, white cells, and platelets. At that time, it might have been classified as aplastic anemia. The response from repeated transfusions, however, was such that the red cell picture was much improved though the platelets remained at a low figure, and as an example, on May 29, the red cell count was 4,200,000, hemoglobin 84 per cent, platelets 92,000, white cell count 5,400 with 93 per cent lymphocytes. Had the patient first been seen at this time the diagnosis from the blood picture could easily have been thrombopenic agranulocytosis with the red cell picture unaffected.

Because of the clinical picture of multiple hemorrhages the diagnosis was purpura hemorrhagica. At the time of splenectomy the patient had 2,000,000 red cells, 18,270 platelets and 2,600 leukocytes, of which 36 per cent were granulocytes. Splenectomy in this instance produced a temporary cessation of bleeding and improvement of the patient, though why such improvement should result is impossible to state, since little is known about the function of the spleen, but it is quite probable that it amounted to a removal of the normal destructive agent, thus allowing a period of time during which the bone marrow was producing its meager output with no compensatory destruction of platelets by the spleen. Six days before splenectomy a biopsy of the bone marrow showed clearly that the process was essentially a bone-marrow dyscrasia, as evidenced by the absence of myelocytes and megakaryocytes.

However, the patient grew steadily worse, the platelets continued low, hemorrhages became more frequent, the leukocyte count remained low with about 90 per cent lymphocytes, ulcers appeared in the buccal cavity, finally the red cell count fell below one million because of repeated hemorrhages and dysfunction of the marrow, and death supervened. This case affords an excellent example of the importance of distinguishing between thrombopenic agranulocytosis, a bone-marrow disease, and idiopathic thrombocytopenia, a disease presumably of the spleen. It is also an example of the importance of closely and carefully studying the blood picture over a long period of time, since it illustrates the changing picture, and the shifting blood cellular elements, from which various diagnoses can be deduced at different times.

#### PRESENT STATUS OF AGRANULOCYTOSIS

The granulopenias and agranulocytosis have now been evident for the past ten years, though some cases were reported prior to 1922. About 250 cases are recorded at this time, reports coming largely

from Germany and the United States. It is certainly more widespread than reports indicate, and is apparently increasing. It is a disease seen chiefly in middle-aged women, seldom, if ever, seen in Negroes, occurring occasionally in infants and in very old people. It is seldom seen in charity hospitals, and if so, a history of previous treatment of various types, is the rule. It seems unusually prevalent in nurses and physicians, and occurs in the middle or better class people. Three naval medical officers have been victims. It has been reported by Sharp (7) in a seaman whose duties were largely in the charging room of a submarine. He made a most valuable contribution in the thorough and systematic manner in which he investigated the possible etiological factors in his case.

The etiology remains unknown. The *Bacillus pyocyaneus* has been suspected because of its isolation from the mouth ulcers and blood stream in several cases. I have not been able to reproduce it in laboratory animals, using the various organisms isolated from nine cases. The spirillum of Vincent and fusiform bacillus have been suspected, because of the large number with a history of pyorrhoea, Vincent's infection, teeth extractions, etc., prior to the onset of the disease. It is well known that various chemicals, as arsenic, phenylhydrazine, benzene, etc., are capable of reducing the leukocyte count, though the erythroblastic tissues are usually affected. The writer (8) has been able to produce the disease in rabbits by the injection of small doses of benzene over long periods of time, producing a marked leukopenia with the red cells unaffected, the animals oftentimes dying with terminal infection from normally present or injected bacteria.

Treatment seems to be of little value. About 85 per cent have died, and due to the tendency toward remissions, that figure would probably be increased if final reports were available. Frequent transfusions should be employed, using the blood of one who has recovered from the disease, if possible. Hinton and Chrisman (9) report three cures in as many patients. Fisher (10) reports one cure. I can find no report of this procedure being used with death of the patient, though its use is necessarily very limited. X-ray therapy in one-twentieth erythema doses should be applied to the long bones every day or alternating days, with careful checking of the blood picture to avoid excessive dosage which becomes destructive instead of stimulating. Liver extract by mouth should be used. The use of any substance which promises to stimulate the bone marrow, is justified. Notable among these is adenine sulphate, the value of which, however, is doubtful. Colloidal sulphur is worthy of a trial, since it has been well established that it is capable of stimulating the myelocytic tissues to increased production. Local treatment of ulcerations should be carried out with any of the mild antiseptic

agents. General supportive measures, particularly cardiac stimulation, are, of course, necessary. Leukocytic extracts seem to be of little value.

It should be emphasized that all physicians who have the opportunity to study these cases, should use every effort to make close clinical observations, extensive laboratory studies, and obtain detailed histories that may throw light on the etiology which is now shrouded in obscurity. Until this is done in a sufficiently large number of cases, the collection of statistical data of importance will be of little value.

#### SUMMARY

1. The importance of leukopenia is emphasized.
2. Agranulocytosis is a serious clinical entity, highly fatal, apparently on the increase, affects the better type of people, and treatment seems to be of no avail.
3. The mild leukopenic states are discussed.
4. Thrombopenic agranulocytosis is described, and the importance of differentiation from idiopathic thrombocytopenia is stressed.
5. A case with an obscure and peculiar blood dyscrasia, in the naval service, is presented and discussed.

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**THE ASCHHEIM-ZONDEK PREGNANCY TEST<sup>1</sup>**

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The need for an accurate test for the diagnosis of pregnancy is generally recognized. The clinical signs of early pregnancy are indefinite. It is often desirable for therapeutic and prognostic reasons to make an early diagnosis of pregnancy when the case is complicated by pulmonary tuberculosis, diabetes, heart, or kidney diseases. Of vital importance is the differentiation between intra-uterine and ectopic pregnancies, and tumors, cysts, or inflammatory conditions of the pelvic organs, a differentiation which is often difficult to make.

The Abderhalden and several other pregnancy tests have been tried in the past, but were abandoned due to unreliability. The test to be of value should be specific, simple of application, and become positive in the early weeks of pregnancy.

The Aschheim-Zondek pregnancy test is now about three years old and several thousand tests have been reported in the literature, including pregnancies of all durations, and ectopic, the various gynecologic conditions and various phases of the menstrual cycle, together with normal controls. The average accuracy of the reported tests has been about 98 per cent, which corresponds favorably with other laboratory tests. The test is simple of application and is strongly positive in the early days of pregnancy, in fact it has been reported three days after the first missed menstrual period.

Certain basic discoveries of the rôle played by hormones from various organs in sex physiology have laid the foundation of the test.

In 1909 Erdheim and Strumme (1) noted that the chromophobe cells of the anterior pituitary lobe undergo hyperplasia during pregnancy. More recent work by Evans and Simpson (2) indicates that the chromophobe cells have a sex maturity provoking effect and the eosinophilic cells a growth effect which acts in an inhibitory manner to prevent sexual maturity until proper skeletal growth has been attained. Other workers investigating the hormones of the ovaries have shown that folliculin, the female sex hormone from the maturing follicles, produces growth of endometrium, cornification of vaginal epithelium and estrus in animals. Also, that a hormone of the corpus luteum produces progestational proliferation of endometrium facilitating the implantation of the fertilized ovum and inhibits maturation of follicles during its active existence.

During 1926-27 Zondek and Aschheim (3) (4) in Germany, Smith (5) and Smith and Engle (6) in this country, by transplanting bits

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<sup>1</sup> Read before the meeting of the American College of Physicians, Washington, D. C. March 28, 1931.

of anterior pituitary tissue intramuscularly into immature female animals, provoked precocious sexual maturity with maturation of ovarian follicles, ovulation, and corpora lutea formations.

From these experiments Zondek and his fellow worker Aschheim concluded that through hormonal action the anterior pituitary lobe was the activating factor in the periodic maturation of the ovarian follicles, hence they termed the anterior pituitary the motor of the ovaries. Knowing that the anterior pituitary was hyperplastic during pregnancy, they reasoned that increased amounts of the hormone might be present in the body fluids at this time. By injecting either the blood or urine of pregnant women into immature female mice they were able to demonstrate the presence of the hormone in quantity, as evidenced by rapid changes in the ovaries and uterus with the production of estrus in about 100 hours. They divided the ovarian changes into three types of reaction:

*Reaction 1.*—Maturation of follicles.

*Reaction 2.*—Hemorrhage into enlarged follicles with formation of blood points.

*Reaction 3.*—Formation of corpora lutea—yellowish white, opaque bodies. The swelling and congestion of the uterus with cornification of the vaginal epithelium and estrus, which also usually occur, they considered to be due to folliculin, hence not an indication of the presence of anterior pituitary hormone.

Reaction 2 or 3, that is, hemorrhagic follicles or corpora lutea, were considered specific reactions for pregnancy.

In 1928 Aschheim and Zondek (7) (8) (9) announced their pregnancy test, which is an indirect one, being a biologic test for the anterior pituitary sex hormone made by injecting immature female mice with the patient's urine and examining the ovaries for hemorrhagic follicles and corpora lutea.

*The technique of the test as used at the Naval Medical School.*—The first urine voided in the morning is collected in a clean, but not necessarily sterile bottle. The early morning specimen contains the hormone in greatest concentration. If the urine is to remain out of the refrigerator for a considerable length of time one drop of tricresol to each 25 cubic centimeters of urine is added to retard bacterial growth. If not acid, the urine is acidified with acetic acid and filtered. Five immature, female mice three to five weeks old and weighing from six to eight grams each are used for each test. Five mice are used because there is a mortality of from 10 to 15 per cent, and occasionally a mouse will not react to the hormone. The mice are injected subcutaneously in the back twice a day for three days, each mouse receiving 0.3 cubic centimeter of urine at each injection. At the end of 100 hours from the first injection

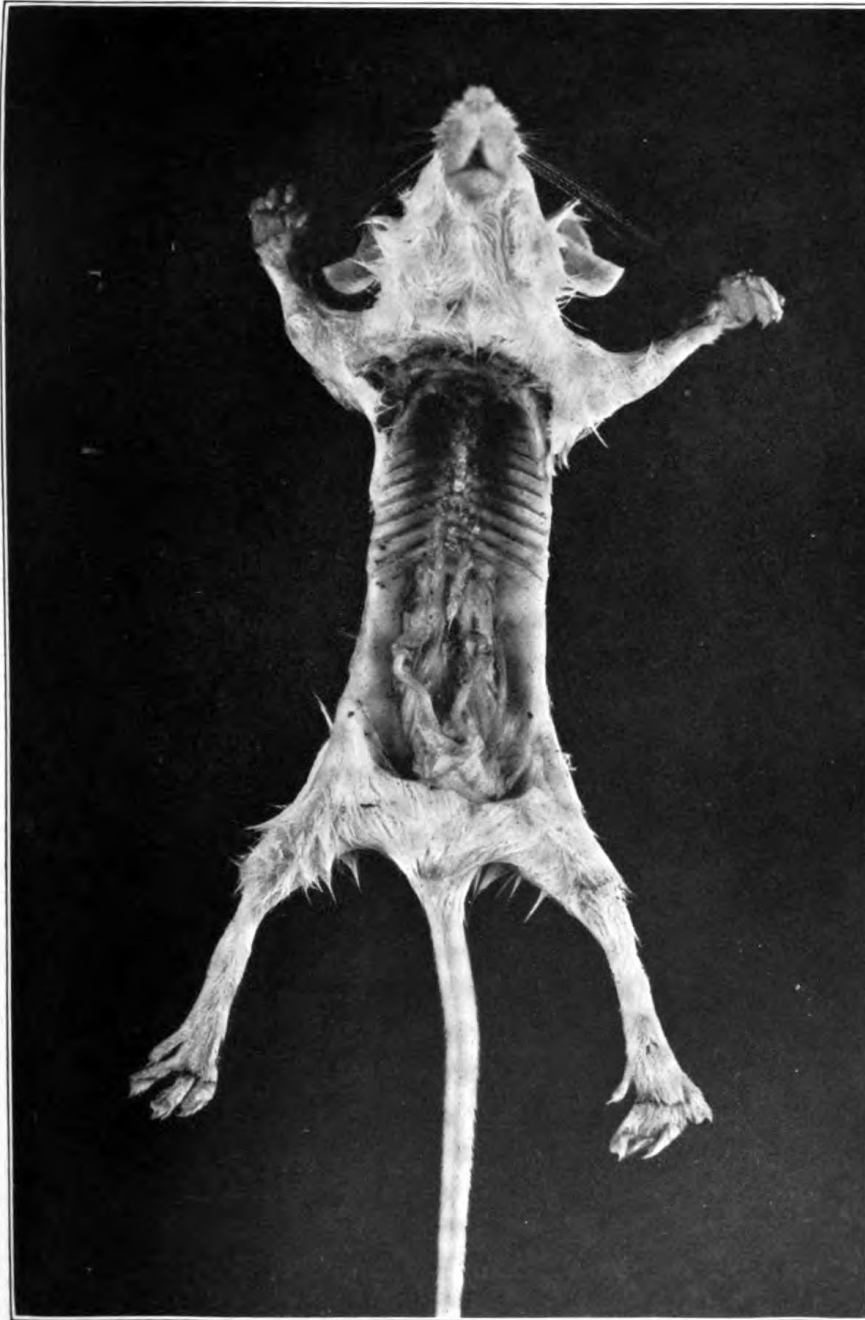


FIGURE 1.—NEGATIVE ASCHHEIM-ZONDEK TEST. NORMAL INFANTILE  
OVARIES AND UTERUS

28—1



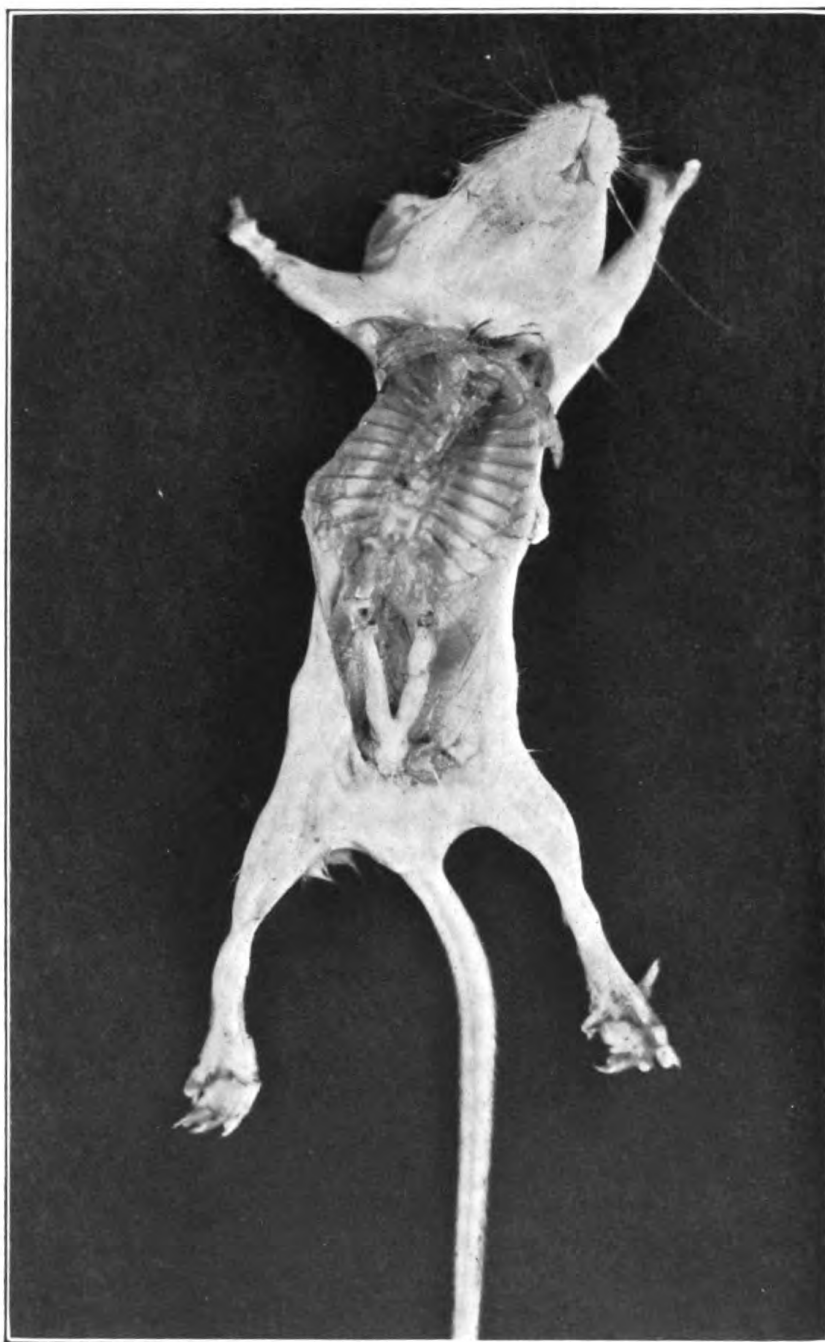


FIGURE 2.—POSITIVE ASCHHEIM-ZONDEK TEST. HEMORRHAGIC FOLLICLES IN OVARIES. CORPORA LUTEA DO NOT SHOW WELL IN THE PHOTOGRAPH. UTERUS SWOLLEN

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the mice are killed with illuminating gas and the ovaries examined either macroscopically or under a low power, binocular, dissecting microscope. The presence in any of the ovaries of corpora lutea as evidenced by round, yellowish, opaque spots, or hemorrhagic follicles is a positive test. Occasionally a specimen of urine is found which is highly toxic for the mice. In these cases we have been using a method suggested by Zondek in which the urine is thoroughly shaken with three volumes of ether, which removes the toxic substances. The urine is then separated and injected.

The anterior pituitary hormone will usually be present in sufficient concentration in the urine of the pregnant woman to give a positive test as early as 5 to 10 days after the first missed period. The hormone reaches its maximum concentration during the first month and remains high during the first half of pregnancy and gradually declines during the latter half to become negative on the eighth day after delivery. The test also becomes negative a few days after abortion or death of the fetus. Two conditions beside pregnancy give a positive test. They are, hydatidiform mole and chorionepithelioma, both of which show very high concentrations of anterior pituitary hormone in the urine. A positive test after hysterectomy for malignant chorionepithelioma is evidence of metastases and a positive test after removal of a hydatidiform mole is a check on the incompleteness of removal. It would seem, therefore, that viable chorionic epithelium is necessary for the stimulation of compensatory overproduction of anterior pituitary sex hormone and its excretion by the kidneys in amounts sufficient to give a positive test.

The greatest difficulty with the test is the animal supply, but we have had no difficulty in obtaining female mice of the proper age from commercial sources or from our own animals. Young rats give the same results. We have also used rabbits, giving a single injection of 5.0 to 7.0 cubic centimeters of urine intravenously as in the method of Friedman (10) and Schneider (11). Readings can then be made in from 24 to 30 hours, but one rabbit is more expensive than 5 mice.

Our first 100 tests in which final clinical diagnoses were made have checked in each instance except in 2 very early cases, tested 1 and 5 days after the first day of the missed period. Subsequent tests were positive. Our earliest positive test was obtained 10 days after the first day of the missed period.

Final clinical diagnosis	Aschheim-Zondek test	
	Positive	Negative
Pregnant:		
Test made 1 day after first missed period.....	0	1
Test made 5 days after first missed period.....	0	1
Test made 10 days after first missed period.....	1	0
Test made 15 days after first missed period.....	1	0
First trimester.....	40	0
Second trimester.....	12	0
Third trimester.....	14	0
Tubal pregnancy, 6 weeks to 2 months.....	3	0
Amenorrhea.....	0	5
Salpingitis.....	0	6
Endocervicitis.....	0	4
Uterine fibroids.....	0	2
Cystitis.....	0	3
Cancer of uterus.....	0	2
Hysteria.....	0	1
Retroversion.....	0	1
Normal: Premenstrual phase.....	0	3
Total.....	71	29

Since the above was written we have examined 126 additional urines with entirely satisfactory results.

Recently the technique has been modified to conform to Zondek's (12) latest modification and is now as follows: 30 cubic centimeters of fresh, filtered, morning specimen of urine are added to 90 cubic centimeters of ether in a separatory funnel and shaken vigorously for 3-5 minutes. The urine is separated and allowed to stand in the open air for about one hour to evaporate any ether it may contain. 0.9 gram of glucose is now dissolved in the urine. Five female mice weighing from 6.5 to 8.5 grams each are injected subcutaneously with 0.5 cubic centimeter of the urine three times a day for two days. On the morning of the fourth day the mice are autopsied. The method shortens the time of the test and fewer animals die before the test is completed.

#### SUMMARY

The Aschheim-Zondek test is a reliable method of determining pregnancy, with a wide field of usefulness.

Two hundred twenty-six tests have been made at the Naval Medical School during the past year. The results compare favorably as regards reliability, with other accurate laboratory procedures.

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#### SOME ASPECTS OF THE PERSONNEL DIVISION OF THE BUREAU OF MEDICINE AND SURGERY<sup>1</sup>

By K. C. MELHORN, Captain, Medical Corps, United States Navy

In the belief that a presentation of certain impressions gained in nine months of duty in the personnel division of the bureau might be of some interest, the following observations are recorded.

The personnel division is a "nerve center, a dispatcher's office, so to speak," for an organization of Medical Department personnel numbering 6,000 men and women scattered over the entire globe—on land, at sea, in the air above and in the waters beneath. Its offices should be of the kind where one may feel free to come at any time in the knowledge that he is welcome, that he will be pleasantly received—a place where if need be he can unburden his very soul. Here meet the cross currents of our lives; the successes, the failures, the hopes, the disappointments, the comedies and the tragedies.

Although the nature of the work precludes any opportunity to participate directly in clinical medicine, nevertheless, one must be clinically minded if he is to function effectively. There should be no place in this division for an officer, hospital corps man or nurse who does not exert himself or herself to keep informed of the problems of those in the field. Constant study and careful evaluation of all kinds of data must pertain. There is no time for idleness.

#### ORGANIZATION

The division, in charge of the personnel officer, is divided into four sections:

1. Section of officers (medical and dental).

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<sup>1</sup> Read at weekly staff conference, Naval Hospital and Naval Medical School, Washington, D. C.

2. Section of Hospital Corps men.
3. Section of nurses.
4. Section of reserves.

#### DUTIES

*Assignments.*—To function at their best, units ashore and afloat must have balanced staffs. It is the task of the personnel division to maintain this balance. Were it always possible to anticipate events speed in effecting certain moves would not be so necessary, sudden interruption of pleasant duties would not take place and the dismay and disappointments that sometimes arise on receipt of orders would be measurably avoided. But whatever the cause for transfer from station to station may be, it is hoped that all realize that every assignment of a medical officer, dental officer, or nurse receives the personal consideration and approval of the Surgeon General. In this connection may I offer one suggestion, advice that is based on intimate knowledge of the whys and wherefores of many events of vital importance to one's record. Accept whatever duty you are assigned by the department without a word or act that will reflect adversely on your service reputation. This manner of compliance with orders can not be emphasized too strongly. Be assured that personal as well as official requests regarding assignments are not only most welcome, but are desired by this office. Be also assured that the exigencies of the service must be met and that they take precedence over all other considerations.

*Study of fitness reports.*—An up to date file of records bearing on one's efficiency and service reputation is kept in each office of the division and few if any assignments are made without careful reference thereto. The occasional incompleteness of these reports leads one to believe that some officers fail to realize the frequency with which data bearing on efficiency are studied in the bureau. It is to no one's credit to have a service reputation for slipshod methods of marking or for failure to be consistent.

*Correspondence.*—One of the major duties of the division is that of replying promptly to the many inquiries received daily. None should hesitate to communicate frankly and fully regarding any personnel matter in which it is felt that this division may be of assistance. Statements of preference for duty are always welcome and always considered. Frequently they are of the greatest assistance in arranging assignments. It is always a real satisfaction to those engaged in planning transfers to be assured that such and such a detail meets with the approval of the individuals concerned. Where it is not possible to comply with a request receipt of a detailed explanation is almost invariably appreciated.

*Postgraduate education.*—From the date of entry into the service until retirement opportunities are provided to all for continued advancement in postgraduate education—opportunities that should be utilized by each one interested in his or her future. When a request for a special course at a certain specified time can not be granted, the applicant should not be discouraged. On the contrary one should adopt every legitimate means to approach his chosen goal and not fail to renew the request at a later date. The ever present factor of alternation between sea and shore duty may temporarily delay progress in specialty fields, but the applicant who, in spite of disappointments, persists in his endeavor to improve his training will eventually find opportunity for the satisfaction of every reasonable professional desire.

At the present time (July 1, 1931), service needs for qualified personnel are listed as follows:

## MEDICAL OFFICERS

	Number re- quired	Number quali- fied		Number re- quired	Number quali- fied
Internal medicine.....	100	72	Radiology.....	40	30
Aviation medicine.....	48	38	Neurology and psychiatry.....	50	30
Pediatrics.....	32	4	Chemical defense.....	12	5
Clinical laboratory.....	72	33	Field service.....	22	8
Pathology.....	26	7	Public health.....	23	9
General surgery.....	80	56	Submarine and deep diving.....	16	4
Orthopedic surgery.....	20	12	Physiotherapy.....	13	4
Urology.....	40	35	Chemistry.....	7	4
Gynecology and obstetrics.....	54	35	Supply depot.....	10	6
Eye, ear, nose, and throat.....	55	44	Naval War College graduates.....	35	16
Bronchoscopy.....	15	9			

## DENTAL OFFICERS

Denture prosthesis.....	34	9	Ceramics.....	6	0
Minor oral surgery.....	28	4	Periodontia.....	8	1
Crown and bridge.....	6	6	Light therapy.....	4	0
Root canal therapy.....	8	2	Research, nutrition and diet.....	3	1

## HOSPITAL CORPS MEN

Laboratory technicians (general).....	160	123	Electrocardiograph.....	25	14
Laboratory technicians (chemistry).....	25	4	Anaesthetists.....	100	33
Aviation technicians.....	75	58	Dental technicians.....	196	139
X-ray technicians.....	45	29	Dental mechanics.....	34	32
Physiotherapy.....	50	12	Embalming.....	40	32

## NURSES

Dietitians.....	35	25	Physiotherapy.....	27	17
Instructors.....	20	19	Anaesthetists.....	18	14

Listing these data in percentages the interesting fact is noted that engaged in either part-time or whole-time specialty practice are 52.3 per cent of the Medical Corps, 11.7 per cent of the Dental Corps, 14.6 per cent of the Hospital Corps, and 20 per cent of the Nurse Corps.

In comparing these figures with those for physicians in civil life it is of interest to note that in the cities of Philadelphia and Detroit 65 per cent of all doctors are engaged in part-time or whole-time specialty practice. (Bulletins 9 and 10, Committee on the Cost of Medical Care.) When it is borne in mind that specialists, as well as nonspecialists, in the Medical and Dental Corps are compelled at varying intervals to return to general practice as necessitated by assignments to sea and foreign stations, it can be truly said that specialism in the Navy is not being developed at the expense of general medicine. Furthermore, it should never be forgotten that when a national emergency results in a general mobilization, practically all members of the regular corps become administrators around whom are mobilized the reserve forces who will perform the bulk of the clinical work. This is an important factor either overlooked by or unknown to many officers. It is a vital reason why specialism in the Navy must never be permitted to develop at the expense of the service in general. We agree entirely with the comment by Dudley in his article "Some aspects of specialization and research in the services" (Journal of the Royal Naval Medical Service, April, 1931, that: "The specialist the \* \* \* Navy wants is a man with at least the average knowledge of general medicine and surgery, with an extra training in some specialty in addition thereto but not in lieu thereof.")

## CLINICAL NOTES

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### HERPETIC INFLAMMATION OF GENICULATE AND GLOSSOPHARYNGEAL GANGLIA

#### CASE REPORT

By R. L. NATTKEMPER, Lieutenant Commander, Medical Corps, United States Navy

The patient, a male Filipino, 20 years of age, developed a sore throat with considerable malaise. He was seen by a medical officer shortly after the onset of symptoms, and again 48 hours later. The left tonsil was then swollen and inflamed. A dirty grayish membrane extended over the upper part of the tonsil, anterior pillar, soft palate, and uvula. An eruption consisting of small pustules on an erythematous base which was moist and macerated, was present on the inner surface of the left auricle. These lesions extended into the external auditory canal but did not involve the membrana tympani. The lymphatic glands of the posterior cervical chain on the left side, as well as in the sub-maxillary region, were palpable. The enlarged glands were only slightly tender. He had no fever.

A smear from his left tonsil was reported to have shown bipolar staining bacilli, and the patient was transferred to the hospital as a precautionary measure.

Upon arrival it was considered advisable to administer diphtheria antitoxin in advance of any laboratory work. Accordingly, 40,000 units were given intramuscularly at once. Later, two cultures and several smears were negative for diphtheria bacilli, although the presence of numerous fusiform bacilli and spirilla was reported. Obviously there was no diphtheritic infection. No appreciable reaction of any sort followed the introduction of antitoxin. The patient did not appear to be seriously ill, but he was listless and apathetic.

During the second night in hospital, complete left facial paralysis of the peripheral type developed. There was loss of taste in the anterior part of the tongue on the left side. There was no disturbance of sensation. Hearing was not affected, and there was no palatal or pharyngeal paralysis.

The patient's past history, as elicited, was considered to have no essential bearing on the case. The lesions in the ear and throat were not associated with any neuralgiclike pains, nor did the patient complain of earache. The facial paralysis developed about 72 hours after the appearance of the eruption in the ear.

Laboratory work including blood count, urinalysis, and blood Kahn—negative.

Only mild local applications were made to the throat, and the throat condition in the course of a few days showed improvement. Alcohol dressings to the eruption on the ear resulted in that process entirely clearing up in a few days.

It is possible that a typical vesicular type of herpetic lesions was present earlier, but when the patient came under our observation 48 hours after the appearance of the lesions on the ear, this point could not be determined.

Convalescence continued uneventful and there was practically normal innervation of the left side of the face some six weeks after the first appearance of symptoms.

#### DISCUSSION

The literature on the subject indicates that these cases are rare. In making a study and in writing up this case reference was made to an excellent article by J. Ramsey Hunt.<sup>1</sup>

The geniculate, glossopharyngeal, pneumogastric, and acoustic ganglia are considered as the homologues of the posterior spinal root ganglia.

The specific infective agent of herpes zoster or zona is not known, but it seems to possess a special affinity for the posterior spinal root ganglia. Examinations have shown that the inflammation which occurs in these ganglia in zona has the same general pathological characteristics as in acute poliomyelitis anterior. For this reason, and because herpes zoster involves the posterior ganglionic chain, it has been termed acute posterior poliomyelitis.

In these conditions, the paralytic phenomenon is unilateral and there is an intervening period of several days after the appearance of the eruption before paralysis occurs. This would suggest that the inflammation in the ganglion is progressive and does not reach its full development at the time of the appearance of the eruption. That was the sequence of events in the case here reported.

Varying syndromes following inflammation of geniculate ganglion of the facial nerve have been noted. When the ganglion alone is involved, there results an herpetic eruption distributed to the central portion of the external ear. If the inflammation extends to the nerve trunk, facial palsy follows. In cases where deafness and symptoms of Meniere's disease occur, there is extension to the eighth nerve or to the peripheral auditory ganglion.

The external ear has a very intricate sensory innervation. There are four cranial and two spinal ganglia participating in its nerve supply. Of these, the geniculate and glossopharyngeal ganglia are represented. The two ganglia on the root of the glossopharyngeal nerve also have an intra-oral zone situated on the posterolateral surface of the tongue, pillars of the fauces, tonsils and adjacent pharyngeal regions. In our case the above areas were involved, but there was normal innervation of palatal muscles. The case is of interest as there was an absence of the usual neuralgic-like pain over areas involved and also because the eighth nerve and its ganglion was not involved. Both the geniculate and glossopharyngeal ganglia appear to have been affected as the involved areas in the throat

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<sup>1</sup> Hunt, J. Ramsey: The symptom-complex of the acute posterior poliomyelitis of the geniculate, auditory, glossopharyngeal, and pneumogastric ganglia. Arch. Int. Med. 5: 631, June, 1910.



corresponded to the sensory representation of the glossopharyngeal ganglia.

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#### MYOCARDIAL SYPHILIS WITH ANEURYSM OF THE SINUS OF VALSALVA<sup>1</sup>

By JACK C. NORRIS, Lieutenant (junior grade), Medical Corps, United States Naval Reserve

Warthin (1) of Michigan has satisfactorily proven that myocardial syphilis is a common heart disease. It is usually associated with aortic vessel lesions. The pathological picture is characterized by the presence of yellow-grey or greyish patches within the myocardium. These areas have a semitranslucent, slightly depressed surface. The histology is one of round cell and plasma cell collection within the stroma, between the fibers and about the vessels. The heart muscle wall is usually dilated and thinned.

In this paper the unusual complicating lesion is that of aneurysm of the sinus of Valsalva. This type of aneurysm is very rare. There are many textbooks that fail even to mention its existence.

*Etiology and occurrence.*—W. Atmar Smith (2) of Charleston, S. C., reported two cases in 1914. He reviewed the reports of Cathell and Steele and of Bosdorff, and a combined number of their necropsy studies composing 8,138 deaths revealed this aneurysm to be present in seven individuals. Smith found reports of 17 such aneurysms between 1840 and 1903 and three more during the years 1905 to 1912. Lucke and Rhea (3) reported the observance of the lesion in 10 aortas out of 12,000 autopsies. Symmers (4) of New York made no mention of the aneurysm in his report of 4,880 necropsies. Brindley and Schwab (5) of Texas, studying 2,290 autopsy records, failed to mention its occurrence. Lemon (6) made no report of the tumor in his review of 2,000 postmortems.

Compiling the above necropsies, we have a total of 29,000, among which were 37 aneurysms of the sinus of Valsalva.

The case herewith reported was the only one found out of a total of 700 necropsies.

The lesion, according to Osler (7), is most common in young adults having syphilis. Smith (2) stated that the lesion predominates in the male. The aneurysm results from degenerative changes which weaken the aortic structure at the sinuses. Pressure of the blood flow plays a predisposing part. Congenital exaggeration of the size of the sinuses probably enhances disease manifestations. When inspecting the hearts of newborns I have noted prominent sacculatation of the sinuses on several occasions.

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<sup>1</sup> From the department of pathology and internal medicine, Emory University School of Medicine.

The sinus most often affected seems to be posterior to the right aortic leaflet. In the case presented, the largest sacculation was behind the left valve leaflet.

*Symptoms and physical findings.*—A. R. Lamb (8) wrote that clinical signs are usually absent, though at times the lesion may be associated with aortic insufficiency and cardiac pain. Osler (7) stated that angina pectoris may occur. Smith (2) in his cases noted cough, dyspnoea, pain under nipple of the left breast, and edema of the extremities, dizziness, and headache. Auscultation enabled him to hear a loud humming, "saw-like" murmur over the precordium, the intensity of which was greatest at the third interspace, five cm. from the sternal border. There was a marked thrill best heard in the second and third interspaces to the sternal left; here he also noted the high pitched rasping quality of the bruit, the to-and-fro character of the mechanism, and a rather sharp snap of an accentuated closure.

#### CASE REPORT

D. D. 35535: Colored female, age, 20 years. Chief complaint: Weakness, cough, shortness of breath, and swelling of feet.

One month prior to admission she was bothered considerably with palpitation of the heart, especially after exertion. She also complained of progressive weakness. She since has also suffered from paroxysmal cough and dyspnoea. The dyspnoea was more bothersome at night, but became constant. One week following the dyspnoea she stated that her feet were swollen.

*History.*—Mother died at age of 39 years with heart disease.

*Marital history.*—Married seven years, one still birth.

*Past history.*—Typhoid fever at age of eight years. Influenza, 1918.

*Physical examination.*—She was propped in bed and was very dyspnoeic. Her pulse was rapid, 120 per minute; blood pressure 110/68; temperature, normal. Eyes, ears, throat were normal; lips cyanotic; fundi, normal; pupils reacted to light. Neck and thorax were negative, except for cardiac impulse. The lungs contained moist râles and there were scattered areas of bronchial breathing. The bases were moderately dull to percussion.

*Heart:* An impulse was seen and felt about the fourth and fifth interspace, 10 cm. from the midsternal line. Over this area a systolic thrill was felt. Auscultation at the apex revealed a rough, grating, musical systolic murmur which replaced the first sound; this murmur was followed by a diastolic murmur which had a presystolic roll. Over the heart base these murmurs were also heard and here the systolic roll was very high pitched in character. Over the tricuspid area one could also hear both the diastolic and the systolic murmurs; here the systolic sound was of a very high pitched quality. The P2 was exaggerated.

*Abdomen and liver:* Distended. Enlarged downward.

*Extremities:* Epitrochlears and inguinal palpable and enlarged.

*Reflexes:* Normal.

*Laboratory findings.*—Hemoglobin was 80 per cent; white blood cells 11,400; polynuclears, 69 per cent. Blood chemistry was normal; Wassermann and Kahn, four plus. There was a trace of albumin in the urine. The sputum was negative for tubercle bacilli. Roentgenogram showed cardiac enlargement and numerous areas of consolidation that possibly were tuberculous.

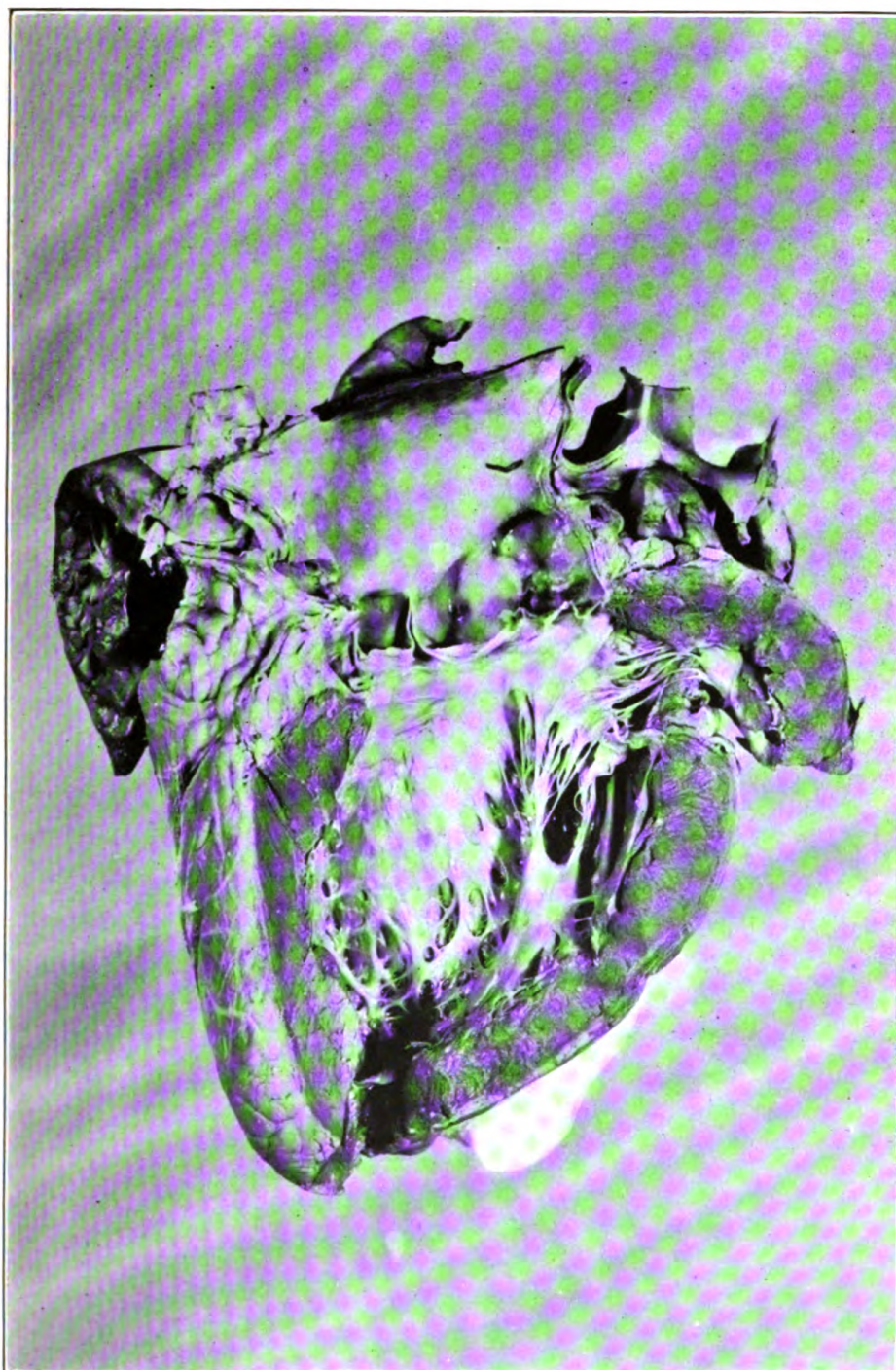


FIGURE 1.—SHOWING THE SINUS ANEURYSM AND THE ULCERATED PROCESS AT THE BASE OF THE ANEURYSM WITH THE DESTRUCTION OF THE VALVE ATTACHMENT

Note the smoothness of the aorta above the sinus ridge. At the apex of the heart the grayish streaks in the myocardium are observed.

38-1



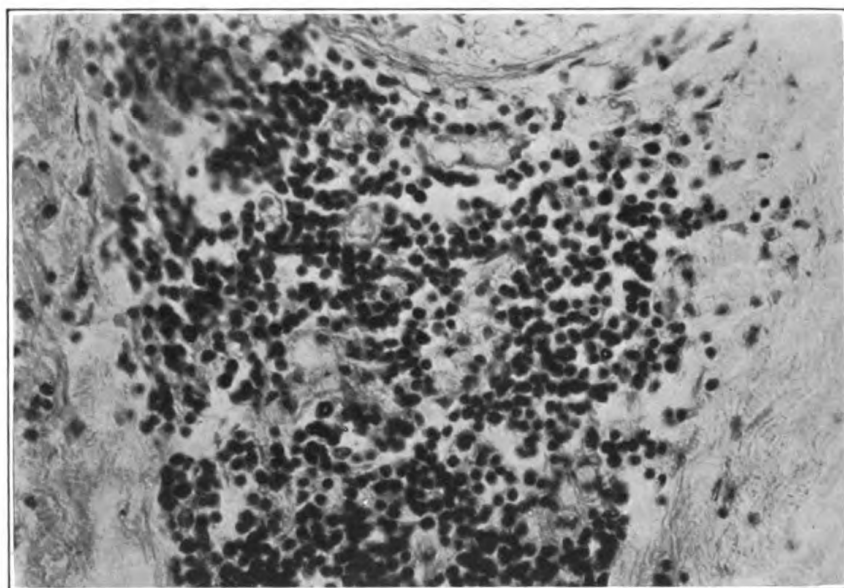


FIGURE 2.—SHOWING INFILTRATION OF ROUND CELLS ABOUT NEW FORMING BLOOD VESSELS

38—2

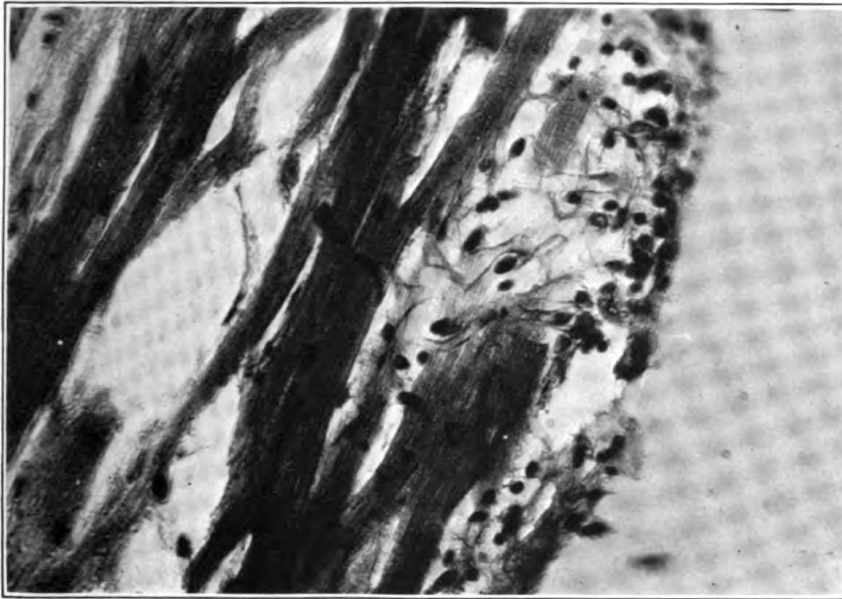


FIGURE 3.—HEART MUSCLE SHOWING ROUND CELL INFILTRATION  
BETWEEN FIBERS

38—3







*Clinical course.*—During the first week in the hospital she improved. Occasionally, she had a slight fever. During the second week she became severely dyspnoeic and had profuse sweats. Later, this was followed by slight hemoptysis, after which she was orthopnoeic. All symptoms became gradually more pronounced, and she died 16 days after admission.

*Necropsy report.*—The body was that of a well developed, well nourished female. She measured 158 cm. in length. Rigor mortis was present. There was considerable edema of the extremities.

The peritoneal cavity contained 600 cc. of clear, yellow fluid. No obstruction or tumor existed.

Both pleural cavities contained 300 to 500 cc. of clear, straw-colored fluid. The lungs were congested and there were numerous red infarcts of various sizes scattered throughout the lung substance. The right lung weighed 700 gm., the left 500 gm. No tuberculosis was present.

The pericardial cavity contained 150 cc. of clear fluid. No pulmonary artery clot was present; no adhesions noted.

The heart was enlarged, weighing 500 gm. The surfaces showed considerable congestion of the small peripheral vessels and the musculature was reddish in color. The right heart muscle wall was very thin, measured 4 mm., and was also moderately dilated. The tricuspid valves, except for extension, were not involved; they measured 13 cm. The pulmonary valves measured 6 cm. The mitral valves showed evidence of a slight deficiency and measured 10 cm. The aortic valves measured 6.5 cm.; there was a detachment of the middle and left cusp ridge and at this point degenerative changes were noted. The right sinus of Valsalva was pouching and measured 1 cm. in depth and width. The middle and left sinuses were fused, and here there was an aneurysm that measured 3.5 by 2 by 2 cm. At the lower ridge and apex of this aneurysm an ulcerated syphilitic process was observed. The aorta was not involved above the superior sinus ridges. The cut surfaces of the musculature of the left heart showed innumerable regressive, greyish patches diffusely scattered throughout the musculature.

Liver: Enlarged remarkably and showing chronic passive congestion.

Kidneys: Soft and moderately swollen, with considerable cloudy swelling and congestion.

Spleen: Small, but congested. Showed a red infarct.

*Histopathology.*—Lungs: Congestion of alveoli with red blood cells and areas of inflammatory reaction with numerous polynuclears. Edema.

Liver: Marked chronic passive congestion. Slight fatty change noted.

Aorta: Numerous round cells, plasma cells about vessels and in aortic media; occasional polynuclear. Some areas were densely infiltrated with lymphocytes.

Heart: Cloudy swelling and edema of muscle fibers. Scattered round cells in connective tissue stroma and between fibers. Slight increase in stroma.

#### DISCUSSION

The case presented had the clinical and physical findings similar to those enumerated by Smith. The heart findings were very similar, except that this case was complicated with an ulcerated valve lesion which Smith's patients did not have. The added feature is the unmistakable presence of myocardial lesions due also to syphilis and in which cardiac palpitation and rapid pulse suggest a muscular onset. The aorta above the sinuses of Valsalva was not



involved. The patient's death resulted from both myocardial muscle failure and a marked progressive aortic valvular deficiency and a possible early broncho-pneumonia.

#### CONCLUSIONS

1. Aneurysms of the sinus of Valsalva are rare.
2. A case with associated myocardial syphilis is presented. The clinical physical findings suggestive of such lesions are those indicating a rapid myocardial failure with auscultatory findings referable to the aorta and its valves; the to-and-fro murmur with a thrill is very suggestive of this aneurysm.
3. The disease occurred in a young adult with syphilis and this fact is in accordance with findings as observed by others writers.
4. The left and middle sinuses were involved.

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#### VASOPUNCTURE IN SEMINAL VESICULITIS

By M. J. ASTON, Lieutenant Commander, Medical Corps, United States Navy, and C. M. DUMBAULD, Lieutenant, Medical Corps, United States Navy

In 1905 Belfield (1), in an article on the surgical treatment of pus tubes in the male, mentions having in several cases injected an antiseptic solution into the seminal vesicles through a needle introduced into the vas. He drew no conclusions as to the therapeutic results which followed this novel procedure. The next year he (2) writes of incising the vas transversely and suturing the cut ends to the skin. The purpose of this operation was to afford a ready means of repeatedly injecting the vas, and to secure drainage of the seminal vesicle. To facilitate the latter he passed silkworm gut through the vas to the seminal vesicle. In 1913 he (3) cites three cases of

retrograde urination through vasotomy fistula, where the patients had resisted a desire to urinate.

Since Belfield's original work, injection of antiseptics into the seminal vesicles by way of the vas has become a recognized and increasingly popular procedure. Considerable difference of opinion, as to the method to be employed and the antiseptic to be used, has existed. The chief concern has been with the causation of stricture in the vas and resulting sterility. Various antiseptics have been accused of causing stricture. Both vasopuncture and vasotomy cause stricture in some cases. In this latter connection Thomas and Bird-sall (4) by a series of experiments on dogs found stricture occurred in 55 per cent of vasotomies and 5 per cent of vasopunctures. In 33 per cent of vasotomies the occlusion of the vas was bilateral. Collargol 10 per cent solution was used for the right vas, and 5 per cent solution for the left vas. An equal percentage of strictures occurred in the vasotomy operations regardless of the strength of the solution used; the single occlusion in vasopuncture was with the stronger solution. Collargol 5 per cent to 10 per cent solution is the antiseptic generally preferred.

The indications for injection of the vas are infection of the seminal vesicles, and conditions arising from, or aggravated by, such infection. Conditions for which vas injection may be employed are:

1. Seminal vesiculitis acute and chronic.
2. Epididymitis as result of seminal vesiculitis, especially if recurrent.
3. Vasitis, if not swollen, to prevent epididymitis.
4. Persistent posterior urethritis if kept active by seminal vesiculitis.
5. Prostatitis acute or chronic if seminal vesiculitis is present.
6. Metastatic infections: (a) Gonorrheal arthritis; (b) gonorrheal iritis; (c) gonorrheal periostitis.

We have used the vasopuncture method of injection except in two cases. The technique employed is as follows: 2 to 4 cc. of 2 per cent novocaine is injected into the spermatic cord at the external ring. The scrotal skin is infiltrated in the upper anterior surface with 1 per cent novocaine. An incision about  $\frac{3}{4}$  inch long is then made along the line of infiltration. The vas is picked up by the fingers through this incision. A sharp pointed hook is passed beneath the vas. The sheath of the spermatic cord is incised, and the vas alone is picked up by a second hook. The vas is freed from its own sheath, and a knife handle slipped beneath it. A 26-gage hypodermic needle is now introduced into the vas toward the seminal vesicles. The patency of the vas may now be tested by injecting an aqueous solution of methylene blue and recovering the dye from the bladder by catheter. As we use a comparatively mild solution (5 per cent

argyrol) this test of patency was omitted in our series. The seminal vesicle is injected slowly, and by moderate pressure. If too great a pressure is used, or occlusion of vas is present, the fluid will escape around the needle. This escape will also occur when undue traction on the vas narrows its lumen, hence care must be used not to stretch the vas too greatly. From 6 to 10 cc. of 5 per cent argyrol was used in our cases. This was followed by 2 cc. of sterile water or normal saline solution to free the vas of argyrol and to prevent leakage of the antiseptic after the needle was withdrawn. If col-largol or one of the more irritating solutions is used, it is wise to suture the puncture wound made by the needle. For this purpose a very fine needle and 00 or 000 plain catgut is used, and as little as possible of the vas wall included. The vas is then released and gentle traction made on the testicle to straighten the cord. The sheath of the cord is then sutured with fine plain catgut. Finally, the scrotal wound is closed by two silkworm gut sutures, the ends of which are left long for securing a hemostatic roll dressing.

The patient may be allowed up and about immediately following the operation, if his previous ailment permits. Argyrol is recovered in the first postoperative urine. If no acute condition is present a course of gentle massage of prostate and vesicles should be given. It is best to wait for a week or so before massage is started. This allows time for the antiseptic to adequately do its work, and for any irritation set up in the vesicles by the antiseptic, to have subsided.

Four other methods of treating seminal vesicle infections are used:

1. Vesiculotomy is now seldom employed, because the results are not commensurate with the seriousness of the operation.

2. Vesiculectomy is a formidable operation and should be reserved for such infections as do not yield to vasotomy, or for tuberculous infection of the vesicles.

3. Injection of Pregl's iodine solution into or around vesicles through the rectum is recommended by Stellwagon, but has not been generally accepted.

4. Injection of vesicles by way of ejaculatory ducts is often a very difficult procedure, because of the small size of their openings and their variation in location. In many cases the ampulla can not be filled by this method. Where it is possible to fill the ampulla there may be danger of carrying the infection to the epididymis and setting up an inflammation there. Instrumentation of the urethra should not be undertaken in the presence of a purulent discharge, and valuable time may be lost before treatment by this method can be instituted.

## CASE REPORTS

Five cases of arthritis were treated by vas injection. In two of these the results were spectacular. In one the results were good. Two had temporary benefit. Both of these latter cases were found later to have abscessed teeth. One was cured by extraction of the teeth; the other had noticed little change when he left the hospital. In three of these cases the urine cleared up and the number of pus cells in prostatic secretion diminished following operation.

*E. J. N.*—Patient developed gonorrhea while in hospital for herniorrhaphy. He had a previous attack 14 years before, with bilateral epididymitis. Urine cleared up after about one month of treatment. Prostate was moderately enlarged and boggy. The right seminal vesicle was markedly enlarged and indurated. The left seminal vesicle was slightly enlarged and indurated. The prostatic secretion at first contained many pus cells with clumping but after a few massages these were reduced to 20–40 cells per high-power field. Patient then left the hospital. One week later he returned with an acute inflammation of the left wrist joint. The joint was swollen, red, hot, and painful to touch and motion. Bilateral vasopuncture was done. The left vas was injected with 3 cc. of a 20 per cent silvol solution, and the right vas with 7 cc. of the same solution. The day following operation all signs of inflammation in the wrist joint had subsided except for a little pain remaining on motion, and a very slight residual swelling. On the second day following operation all swelling had disappeared. There has been no recurrence to date.

*F. M. R.*—For the past seven months the patient was confined to bed with pain in joints of the hands, feet, and in the knees and back. Urethral discharge, which started soon after appearance of arthritis, was still present and contained Gram-negative intracellular diplococci. He had lost 30 pounds in weight. The prostate was moderately enlarged and indurated. Prostatic secretion contained many pus cells with large clumps. Patient was treated for 10 days with prostatic massage and foreign protein, with no improvement. Vasopuncture was then done and 5 cc. of 5 per cent silvol was injected into each vas. The day following operation patient was up and able to straighten his back for the first time in seven months. Physiotherapy, intravenous mercurochrome, and prostatic massage further improved his condition and he was able to go to work in six weeks. The urine became clear in about three weeks and the prostatic secretion was reduced to 30–40 pus cells per high-power field in about six weeks.

*E. P. C.*—Patient admitted with involvement of both ankles, right wrist, left knee, and right temporomaxillary joints. He had a purulent urethral discharge which was positive for Gram-negative intracellular diplococci. After 12 weeks' treatment, during which time he received eight intravenous injections of mercurochrome, three intramuscular injections of milk, physiotherapy and prostatic massage, the pain and swelling had for the most part subsided. Patient complained of some stiffness remaining in ankle joints, and in left knee. Bilateral vasotomy was then done, and 10 cc. of 5 per cent silvol was injected into each vas. One week following operation there was marked lessening of stiffness in affected joints. Patient then left the hospital and was not observed further.

*W. H. D.*—Patient admitted with pain in back and urethral discharge of three months' duration. Gonococci were found in stained urethral smear. Prostate was found to be slightly enlarged and indurated. The prostatic secretion contained many pus cells with large clumps. There was slight improvement

following four intravenous injections of mercurochrome. Left vasopuncture was then done and 8 cc. of 5 per cent silvol injected. The pain in the back cleared up to some extent following operation, but recurred in a few days. After vasopuncture the urine began to clear up in about a week and was clear in all glasses in a month. The prostatic secretion showed less pus two weeks later. Three abscessed teeth were later found and extracted, and the pain in the back then subsided.

*C. N.*—Patient admitted complaining of pain and stiffness in right shoulder. For past four months he had been receiving treatment for gonorrhea. There were no signs of acute inflammation about shoulder joint and X-ray was negative for pathology. Patient had a purulent urethral discharge and stained smear showed gonococci. He was given five intravenous injections of mercurochrome, with some slight improvement in his arm. He also received prostate and vesicle massage. Prostate was found to be enlarged and soft. The right vesicle was markedly enlarged and indurated. Prostatic secretion contained many pus cells with large clumps. Bilateral vasopuncture was performed and 4 cc. of 5 per cent silvol solution injected into the right vas, and 10 cc. of 5 per cent silvol into the left vas. Some temporary improvement in his arm followed operation. There was rapid improvement in urethral discharge and urine was clear in three weeks. The number of pus cells in the prostatic secretion decreased to some extent. Two abscessed teeth were found and extracted. Following this, two intravenous injections of mercurochrome were given. When the patient left the hospital, two weeks after extraction of teeth, there was no further improvement in arm.

#### CHRONIC PROSTATITIS AND SEMINAL VESICULITIS OF NONVENEREAL ORIGIN

*R. S.*—Complained of dull aching pain in bladder of nine years' duration. Cystitis, prostatitis, and seminal vesiculitis found on examination. Treatment with urinary antiseptics by mouth, bladder, irrigations, dilatation of posterior urethra, and prostatic massage for four months resulted in some improvement. Bilateral vasopuncture with injection of 5 cc. of 5 per cent solution of silvol into each vas was then done. This operation was followed by further symptomatic improvement, and patient was discharged from the hospital one month later.

#### SUBACUTE GONOCOCCUS INFECTION OF THE PROSTATE AND SEMINAL VESICLES

*W. A. T.*—Patient admitted with acute prostatitis and seminal vesiculitis, and soon after admission he developed a right sided epididymitis. Scanty urethral discharge containing gonococci was present on admission. The epididymitis subsided in about two weeks with intramuscular injections of foreign protein (milk) and intravenous mercurochrome injections. A copious purulent urethral discharge containing gonococci then developed. Deep irrigations and massage of prostate and vesicles, started three weeks later, were continued for two weeks with little effect on the patient's condition. Both vesicles were enlarged and indurated. Prostatic secretion contained many pus cells with clumping, urethral discharge continued copious. Bilateral vasopuncture was decided upon. At operation the left vas was injected with 8 cc. of a 20 per cent solution of silvol and the right vas with 3 cc. of the same solution. Two weeks later the urine was clear in all glasses and the number of pus cells in the prostatic secretion had diminished to 20-40 per high dry field.

## A CASE OF RECURRING GONORRHEA

8. The patient gave a history of numerous attacks of gonorrhea over a period of 10 years. These recurrences followed sexual intercourse or alcoholic indulgence. On admission patient had a moderate urethral discharge which had resisted treatment for six weeks. Stained smear from urethra was positive for Gram-negative intra and extra cellular diplococci. The prostate was irregular and slightly enlarged; both vesicles were enlarged and indurated. Prostatic secretion contained many pus cells with clumping. Bilateral vasopuncture was performed. The right vas was injected with 6 cc. and the left vas with 8 cc. of a 20 per cent solution of silvol. Two weeks after operation the urine was clear in all glasses, and the prostatic secretion was normal in appearance.

In cases of epididymitis, where an epididymotomy had been necessary, we have recently been doing vas injections at the same time, if the vas itself was not too greatly inflamed. In none of these cases has there been a recurrence of the epididymitis and in some there has apparently been a beneficial result in lessening the subsequent duration of the urethral infection.

*Complications.*—In three cases there has occurred a secondary funiculitis due to leakage of silvol from the puncture wound in the vas. All of these occurred on the right side. We have found that the right vas is usually more difficult to inject than the left, and in two of these cases more than one puncture wound was necessary. The funiculitis slowly subsided, and in only one case did it cause more than a slight discomfort to the patient.

## SUMMARY

1. Vasopuncture and vasotomy were originated and popularized by Belfield. Thomas and Birdsall have shown by experiment on dogs that vasopuncture caused strictures of vas in 5 per cent of the cases, whereas vasotomy was followed by strictures in 55 per cent of cases.

2. The technique used by the authors is described. The manner of isolating the vas by means of sharp-pointed hooks has simplified the operation for us, and is, as far as we have been able to learn, a new procedure.

3. A number of case reports are given. In all but two cases both the urethral and prostatovesicular conditions cleared up. The two cases of arthritis which did not respond to vasopuncture emphasize the necessity of excluding other foci of infection before incriminating the gonococcus, even in the presence of a positive urethral discharge.

4. Complicating funiculitis may follow vasopuncture due to leakage of solution from the puncture wound. The right vas was found to be more difficult to inject than the left.

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- (3) Belfield, W. T.: Vasotomy—radiography of the seminal duct. *J.A.M.A.* 61: 1867, Nov. 22, '13.
- (4) Thomas, B. A., and Birdsall, J. C.: Vasopuncture versus vasotomy relative to stricture formation; experimental study on dogs. *J. Urol.* 16: 529, Dec. '26.

## SPINAL FLUID EXAMINATION IN SYPHILIS

By M. J. ASTON, Lieutenant Commander, Medical Corps, United States Navy, and  
R. K. Y. DUSINBERRE, Lieutenant, Medical Corps, United States Navy

The purpose of this article is to review briefly the indications for spinal-fluid examinations in syphilis. No originality is claimed for these indications, for they represent the thought of the leading authorities on syphilis. It is believed that a review of the indications and a wider application of them might be helpful in bringing the treatment of syphilitics in the Navy up to the highest modern standards. A review of the syphilitic abstracts at almost any naval activity will probably show a sprinkling of cases in which spinal-fluid examination is indicated. Judging from the frequency of positive findings in cases where this examination has been made, it is the authors' opinion that there is a considerable number of cases of asymptomatic neurosyphilis in the Navy, which should be definitely diagnosed and adequately treated. When the incidence of syphilis in the Navy is considered it is seen that we have a fruitful field in which to work. The incidence (not to be confused with the annual rate of new infections) reaches approximately 10 per cent of personnel on the Asiatic station. This is a high figure, to be sure, and not the average, but it serves to emphasize the extent of the possibilities of neurosyphilis. If we conservatively estimate that 2 per cent of naval personnel have a record of syphilis, this would mean that approximately 1,600 service men should have a spinal-fluid examination within the year, for one or another indication.

Four cases from the genito-urinary service of the United States Naval Hospital, League Island, are reviewed and discussed. These cases are not unusual, and show the insidious nature of neurosyphilis. They are selected from naval-service patients to illustrate the indications as they will appear to the naval medical officers.

## CASE REPORTS

CASE 1.—Chief machinist's mate, hospital No. 52,321. This patient was first seen in March, 1930. He had no complaint, but gave the following history:



Penile lesion November, 1927 (two and one-half years before), followed by secondary rash. The diagnosis was made and one course of neoarsphenamine given, with iodides.

A blood Kahn check up on March 3, 1930, was 4 plus, and he was sent by his medical officer to the hospital for out-patient treatment. Hospitalization was advised for spinal-fluid examination.

March 26, 1930: Admitted to United States Naval Hospital, League Island. No complaint. Blood, Kahn, 4 plus.

March 27, 1930: Spinal fluid—Cells, 24; globulin, positive; Kahn, 4 plus; gold curve, 44443210.

August 14, 1930: (After treatment and several spinal-fluid examinations.) Spinal fluid—Cells, 15; globulin, negative; Kahn, negative; gold curve, 00000000.

August 22, 1930: Discharged to duty.

*Discussion.*—It must be admitted that one might expect the nervous system to be infected after such inadequate treatment as one course of neoarsphenamine in the first two and one-half years of the disease. However, this case demonstrates one indication for spinal fluid examination. Regardless of the thoroughness of treatment, every known syphilitic with a positive blood Kahn after one year from infection should have the spinal fluid examined. If positive, a service man should be hospitalized until this complication is shown to respond satisfactorily to treatment. It is obvious that any later check on these patients should be made with a spinal fluid test, because of the possibility of a neurosyphilitic relapse with negative blood Kahn.

CASE 2.—Torpedoman, second class, hospital No. 51387. Admitted February 3, 1930, with gonorrhea of two days duration. Physical examination revealed both pupils dilated, the right 2 mm. larger than the left, and very poor reaction of both to light. A provisional diagnosis of neurosyphilis was made at the time. There was no history or record of chancre.

February 6, 1930: Blood Kahn, negative.

February 10, 1930: Spinal fluid—Cells 19; globulin, slight positive; Kahn 4 plus; gold curve 4443210.

February 20, 1930: Patient called the attention of the medical officer to "sores" on his leg which would not heal. These proved to be typical tertiary syphilids. A few showed active indolent ulceration with scabs. The rest appeared in the same group and showed atrophy of the dermis, smooth, thin epidermis, deep pigmentation, and crescentic borders. The patient stated that he called these to the attention of his medical officer six months before admission to the hospital, and had been given a blood test, which was negative. The examiner who first saw the patient in the hospital believed the skin lesions to be scars resulting from burns.

May 2, 1930: Invalided from service because at the time of survey the duration of treatment seemed indefinite.

*Discussion.*—This case brings out a not uncommon indication for spinal fluid examination. Regardless of negative history or negative blood Kahn, a single symptom or sign suggesting syphilis is sufficient indication for the spinal test. The Argyll-Robertson pupil is virtually pathognomonic, but was the only sign to one examiner

in this case. Together with the syphilid it made the diagnosis, but only the spinal fluid tests showed the extent of the involvement. The case illustrates the deceptive nature of the negative blood reactions, and the necessity of following a suspicion right through with a spinal fluid examination. The diagnosis can sometimes be made in obscure cases with myalgia, general pains, neurasthenia, skin rashes, persistent headache, cardiac arrhythmias, etc., by resort to the spinal fluid tests when the history and blood reactions are negative.

**CASE 3.**—Seaman, second class, hospital No. 55856. Admitted November 22, 1930, with gonorrhea.

December 16, 1930: Kahn, negative. Patient was given routine antiluetic treatment because of record of infection and in spite of the negative Kahn test of the blood. The patient had been infected 18 months before admission, March 5, 1929, and diagnosed early—by dark field. He had received four courses of neoarsphenamine, each consisting of nine weekly injections. Three of these were accompanied by weekly mercury bichloride injections of one-fifth grain each, and the last course accompanied by 70 mercury rubs. All blood Kahn tests were negative before admission and the patient had not received a spinal fluid examination before hospitalization.

January 12, 1931: Blood Kahn, 2 plus.

February 12, 1931: Spinal fluid—cells 35; globulin, slight positive; Kahn, 3 plus; gold curve 11122100.

*Discussion.*—Two facts stand out in this case. First, the patient had considerable treatment, though the mercury fell short of ideal amounts, and, second, the blood reaction never became positive. In view of these facts, and especially when we recall the treatment in case (1), this patient might easily have been dropped from treatment, optimistically, as “cured.” The decision to discontinue treatment is an indication for spinal fluid examination. Some authorities recommend it routinely after six months in cases seen and treated soon after infection. It is quite possible that this patient had a neural infection as early as that in the course of his syphilis. Furthermore, the development of a positive Kahn brought on by treatment—the provocative test—was positive indication that the disease persisted and was a second indication for spinal fluid examination to determine the extent of the disease. Spinal fluid tests would thus take the diagnosis of neural complications in the apparently cured out of the realm of chance.

**CASE 4.**—Fireman, second class, hospital No. 58570. This patient reported without history of venereal disease or symptoms. He stated that he was in the habit of getting his blood tested periodically, that he had a negative blood test about November, 1930, and that on return from southern waters his blood test was 3 plus.

March 18, 1931: On physical examination there was only a questionable inguinal and cervical adenopathy. Hospitalization for spinal fluid examination was advised before institution of treatment, with a view to establishing the diagnosis, if possible, by spinal fluid examination.

May 21, 1931: Admitted.

May 25, 1931: Spinal fluid—cells 28; globulin, positive; Kahn, 4 plus; gold curve 0011310000.

*Discussion.*—In this case the unexplained positive blood Kahn made spinal-fluid examination imperative. A diagnosis based on a positive serum test alone is disapproved in the Manual of the Medical Department. (Par. 2285, (b).) Every effort should be made, therefore, to establish the diagnosis by the search for other indications of disease before instituting the therapeutic test, since treatment may obscure signs and laboratory tests. A repeatedly positive blood test plus a reversal of this test after specific treatment—the therapeutic test—may be considered enough evidence to establish the diagnosis. However, it is difficult to imagine a more unsatisfactory procedure from the patient's standpoint than the therapeutic test, which may take months. The uncertainty of the diagnosis might be a cause for worry or the reason for poor cooperation in treatment. In this case the spinal-fluid examination obviated the necessity of resorting to the therapeutic test and was indicated for diagnostic purposes.

#### SUMMARY

For diagnostic purposes the spinal fluid should be examined in all cases in which even a single sign or symptom suggests syphilis. This should be done even if the blood reaction is negative. In the presence of a positive blood reaction it should be done to confirm the clinical diagnosis, and to determine the degree of involvement, if neurosyphilis is present.

In patients known to be syphilitic the test should be made in the search for an explanation for a persistently positive blood reaction, or relapse of blood reaction after it has become negative. It should be done before any patient is discharged from all treatment as probably cured, even though his blood reaction has been negative throughout treatment. If possible the fluid should be examined after the first six months of treatment.

Lastly, the condition of the asymptomatic neurosyphilitic should always be followed by spinal-fluid tests and not by blood tests alone.

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#### THORACOSCOPY, WITH CLOSURE OF BRONCHIAL FISTULA

By J. A. TOPPER, Lieutenant Commander, Medical Corps, United States Navy, and R. E. BAKER, Lieutenant, Medical Corps, United States Navy

Thoracoscopy is not new, having been performed by Jacobaeus of Stockholm in 1913, for the purpose of dividing, in certain cases, pleural adhesions which prevented the proper collapse of the lung by

artificial pneumothorax in the treatment of pulmonary tuberculosis. However, it has not yet become such a familiar operation (in naval circles at least) as not to warrant case reports. In the present instance a cystoscope was used for the purpose of examination of the intrathoracic site of a bronchial fistula which had developed following the erosion of a lung abscess and for the closure of same by fulguration. No operative procedure can be appraised on the basis of a single case, but the results obtained in this case were highly gratifying.

#### CASE REPORT

A. R., pharmacist's mate, third class, was admitted complaining of "aching all over" and headache. Two days before admission he had a chill and was nauseated and vomited several times and had complained during these two days of general malaise. Also had another chill on the day before admission. Physical examination was negative except for a slight pallor, a mild pharyngitis with cryptic tonsils, and a temperature of 103° F. White blood count on admission was 6,750, neut. 68., lymph. 30, large mono. 1, mast cells 1. Urine was negative for sugar and albumen. Temperature continued high and irregular and he had frequent chills. Pulse was 110 on admission and the rate seemed to be increased or decreased thereafter in proportion to the degree of hyperpyrexia. No thoracic abnormalities were noted on physical examination on the day of admission.

Blood smears were negative for malaria. Patient coughed frequently and expectoration was rather profuse. Sputum was persistently negative for acid-fast bacilli during entire hospitalization. Twelve days after admission patient began complaining of pain in left chest and coughed almost continuously. Was in a semistuporous condition and expectorated large quantities of thick, blood-tinged pus. Respiration was labored and went up to 40 and 50 per minute. Pulse continued high as did the temperature. At this time X-ray of chest revealed apices and peripheral lung fields and diaphragm clear with marked congestion of the bases. The base of the heart was reported drawn sharply to the left and the heart shadow was slightly enlarged. X-ray one week later showed left pleuritis with effusion and thoracentesis was performed, 750 c. c. greenish pleural exudate being aspirated. This was found to contain, microscopically, many pus cells and pneumococci, but was negative for acid-fast bacilli. The following day 425 c. c. of fluid was withdrawn and 2 days after this 600 c. c. The exudate continued to have the character as above noted, being consistently negative for the tubercle bacillus. X-ray at this time showed pleuritis with effusion and pneumothorax of left side, heavy congestion of the left lung (which was collapsed), and a dense area about left hilum that might be a lung abscess. On the thirtieth day after admission to hospital a rib resection was performed under local anaesthesia, 1½ inches of left eighth rib removed in post-axillary line and drainage tube inserted, considerable bloody pus being obtained. Patient's pulse and temperature had continued high and septic in type. Respiration had dropped to 25 and 30. On the day following the operation his temperature rose to 104° and pulse 150 and patient was in shock, much bloody pus draining out; 500 c. c. normal saline and 5 per cent glucose solution given intravenously, with some improvement noted.

Two days after operation the patient developed subcutaneous emphysema about wound which extended, later in the day, to the whole trunk from the neck to the scrotum. This gradually subsided in about one week's time when patient developed a bronchial fistula, air passing directly from bronchus through sinus



FIGURE 1.—BRONCHIAL FISTULA. X-RAY PHOTOGRAPH AFTER  
INTRODUCTION OF CYSTOSCOPE AND CATHETER

50—1





externally through operative wound. There were abscess pockets still draining at this time externally and one of these had no doubt burrowed through bronchial wall producing this fistulous tract. Two months after the fistula developed, it having failed to close naturally, a cystoscope was introduced into the fistulous sinus tract and a ureteral catheter was passed into the bronchus and an X-ray picture was taken. Then a small quantity of 5 per cent argyrol was injected into the catheter with a syringe. This the patient immediately expectorated showing definitely that catheter was in the bronchus. The X-ray, when developed, showed the catheter in the bronchus. Catheter was withdrawn. On the following day the inside of the pocket was anaesthetized with 4 per cent cocaine and the cystoscope reintroduced. A fulgurating catheter was then introduced into the bronchial sinus and the d'Arsonvat current turned on and the sinus fulgurated as the catheter was slowly withdrawn. No air passed through sinus again and the fistula was entirely sealed over. In 10 days time drainage from thoracic wound had completely stopped and wound was healed and the patient was discharged to duty two and one-half months subsequent to the fulguration, a well man. He has been observed frequently since his return to duty (about eight months ago) and is well and strong.

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**FOREIGN BODY IN RECTUM WITH SUBSEQUENT PASSAGE THROUGH LOWER  
GLUTEAL MUSCLES (SACRO-COCCYGEAL REGION)**

**CASE REPORT**

By J. R. SAYERS, Lieutenant (junior grade), Medical Corps, United States Navy

G. M. T., age 20; reported to the sick bay with a small inflamed swelling over the lower gluteal muscles of the lower sacral region adjacent to the coccyx, which was thought to be a pilonidal cyst; this was incised and drained. The patient continued his duties and reported at sick call next day and while being dressed a small point of a foreign body was seen to be protruding from the site of the incision. This was grasped by tissue forceps and a foreign body withdrawn. The foreign body was found to be a wooden pen stock, length 18 cm. by 3.5 cm. in circumference, with the metal end (pen grasp) pointing to the orifice of the incision. The tapering upper end was covered with feces and the varnished paint surface was seen to be somewhat decomposed. The decomposition showed that the foreign body had not been placed in the rectum recently, the time estimated to be about six weeks previous to reporting to the sick bay. The sinus remaining open, after the withdrawal of the pen stock, passed from the rectum to the skin surface of the gluteal-sacro coccygeal region.

Questioning of the patient revealed that about two months ago he inserted the pen stock in his anus, as he stated, "to try to get a sensation"—an auto-erotic act. Losing his grasp on the pen stock it slipped into the rectum, where it remained until removed. During the time the pen stock was lodged in the rectum the patient was fully aware that it was still there and intended to go on leave and have it removed by a civilian physician. Knowledge that it was there caused no undue anxiety except that the patient thought he might "pass it," as it caused no pain until about three weeks ago, when patient was not able to walk in a strictly upright position. The abscess which was forming was not accounted for by the patient as having anything to do with the pen stock in his rectum, nor the fact that he was unable to walk in an upright position. He thought the pain was incident to the abscess and not due to the foreign body. The patient did not exhibit any abnormal signs of degeneracy



or sexual perversion previous to the occurrence, as far as could be ascertained. In fact, he was considered of good habits and normally inclined sexually.

The patient was put to bed under observation for elevation in temperature and for local signs of extensive inflammation as it was thought that a pelvic cellulitis or peritonitis might develop. Later he was transferred to a naval hospital for further observation and treatment.

#### COMMENTS

Of particular interest was the fact that the foreign body was extracted from a sinus at a relative distant point from the rectum. That the patient was not aware that the "soreness" in this region was caused by the pen stock's passage through the gluteal muscles. That he evidenced no particular mental anxiety after losing the pen stock in the rectum which would prompt him to report his condition. The opinion was that the patient was not a confirmed sexual pervert. The placing of the foreign body in the anus was evidently an experimental auto-erotic act, suggested perhaps by reading or hearing of the eroticism of sexual perverts, as the patient presented neither the history nor the characteristics of the pervert.

# NAVAL RESERVE

## MEDICAL CORPS

### APPOINTMENTS, THIRD QUARTER, 1931

Name	Rank	Appointed
Best, Elbridge J.....	Lieutenant Commander, MC-V (S).....	July 25, 1931
Chandler, Fremont A.....	Lieutenant, MC-V (S).....	June 3, 1931
Cook, Wells C.....	Lieutenant (junior grade), MC-V (G).....	June 12, 1931
Deckert, William A.....	do.....	Aug. 8, 1931
Durr, Samuel A.....	Lieutenant Commander, MC-V (S).....	June 30, 1931
English, Glenn G.....	Lieutenant (junior grade), MC-V (G).....	July 20, 1931
Furman, Matthew R.....	do.....	Aug. 4, 1931
Galligan, John J.....	Lieutenant Commander, MC-V (S).....	June 26, 1931
Goldbacher, Lawrence.....	do.....	Do.
Harding, Warren G., 2d.....	Lieutenant (junior grade), MC-V (G).....	Do.
Hodges, Frank C.....	do.....	July 21, 1931
Hull, John C.....	do.....	June 26, 1931
Keane, Martin J.....	do.....	June 23, 1931
Knud-Hansen, Knud.....	Lieutenant Commander, MC-V (S).....	Aug. 4, 1931
McEwan, Duncan T.....	Lieutenant (junior grade), MC-V (G).....	Aug. 11, 1931
McKeever, Duncan C.....	do.....	Aug. 1, 1931
Meyers, Frederick C.....	do.....	Aug. 31, 1931
Oakley, John F.....	do.....	Aug. 11, 1931
Osterheld, Roger G.....	do.....	June 12, 1931
Penza, James V.....	Lieutenant, MC-V (S).....	June 26, 1931
Schafer, William L.....	do.....	June 22, 1931
Schultz, Robert V.....	Lieutenant (junior grade), MC-V (G).....	June 18, 1931
Smith, William D.....	Lieutenant (junior grade), MC-V (S).....	July 16, 1931
Tuttle, Joseph P.....	do.....	June 16, 1931

### PROMOTIONS

Name	From—	To—
Brown, Byron F.....	Lieutenant (junior grade), MC-V (G).....	Lieutenant, MC-V (G).....
Lavan, John L.....	Lieutenant, MC-V (G).....	Lieut. Commander, MC-V (G).....
Marshall, John R.....	Lieutenant, MC-F.....	Lieut. Commander, MC-F.....
Tandowsky, Ralph M.....	Lieutenant (junior grade), MC-V (G).....	Lieutenant, MC-V (S).....
Thurston, Harrison S.....	Lieutenant, MC-F.....	Lieut. Commander, MC-F.....

### TRANSFERS

Name	From—	To—
Bubert, Howard M.....	Lieutenant (junior grade), MC-V (G).....	Lieutenant (junior grade), MC-F.....
Hunt, Jasper S.....	do.....	Do.
Dickinson, Everett H.....	Lieutenant, MC-V (G).....	Lieutenant, MC-F.....

## DENTAL CORPS

### APPOINTMENTS, THIRD QUARTER, 1931

Name	Rank	Appointed
Cercell, Attila V.....	Lieutenant (junior grade), DC-V (G), U. S. N. R.....	July 11, 1931
Repass, Fred G.....	do.....	Aug. 24, 1931
Roberts, Jacob F.....	Lieutenant, DC-V (G), U. S. N. R.....	Aug. 1, 1931
Schmidt, Carl H.....	Lieutenant commander, DC-V (S), U. S. N. R.....	Aug. 3, 1931
Squires, Sidney.....	Lieutenant (junior grade), DC-V (G), U. S. N. R.....	Sept. 19, 1931



## NOTES AND COMMENTS

### LETTERS OF COMMENDATION

In accordance with the statement made in the preface of the *BULLETIN*, the Surgeon General of the Navy appointed a board to select the papers published in the *BULLETIN* during the year 1931 which it considered to be worthy of letters of commendation. As a result of the selections made by the board, letters of commendation have been sent to the officers named below for the papers which appear opposite their names:

Lieut. Commander G. B. Dowling, Medical Corps, United States Navy, Recent Studies of the Dermatophytes, Including a Report of Experimental Inoculations of Monkeys and Guinea Pigs with Two Dermatophytes and One *Blastomycoides* (January).

Lieut. G. DeFoney, Medical Corps, United States Navy, A Psychological Study Made on Candidates for Aviation Training (April).

Lieut. Commander H. C. Weber, Medical Corps, United States Navy, Simulated Deafness (April).

Lieut. (Junior Grade) I. L. Norman, Medical Corps, United States Navy, Lead Poisoning from Chipping on the U. S. S. *Arizona* (April).

Capt. C. S. Butler, Medical Corps, United States Navy, A Glance at Results of the "Last Thirty Centuries" of Venereal-Disease Prevention (July).

Lieut. Commander E. L. Whitehead, Medical Corps, United States Navy, Cancer as a Federal Problem (July).

Lieut. Commander F. F. Murdoch, Medical Corps, United States Navy, and Pharmacist's Mate, First Class, T. L. Smart, United States Navy, A Method of Producing Sterile Blowfly Larvae for Surgical Use (July).

Lieut. Commander L. J. Roberts, Medical Corps, United States Navy, Aplastic Anemia Following Arsphenamine Therapy (July).

Capt. W. H. Bell, Medical Corps, United States Navy, and Lieut. Commander D. Ferguson, Medical Corps, United States Navy, Effects of Super-High-Frequency Radio Current on Health of Men Exposed Under Service Conditions (July).

Lieut. W. M. Simpson, Medical Corps, United States Naval Reserve, Undulant Fever (Brucellosis) (October).

Commander G. F. Cottle, Medical Corps, United States Navy, Splint Manual, United States Navy (October).

A permanent board will be appointed to select the papers published in the BULLETIN which are considered to be worthy of letters of commendation. This board will consist of the commanding officer of the Naval Medical School, the officer in charge of the division of preventive medicine, the officer in charge of the division of personnel, the senior officer of the dental department of the Naval Medical School, and the editor of the NAVAL MEDICAL BULLETIN.

#### ANNUAL REPORT OF THE SURGEON GENERAL, UNITED STATES NAVY, 1931

The Medical Department activities discussed in this report occurred during the fiscal year ended June 30, 1931. The statistics concerning morbidity and mortality rates and other data pertaining to health conditions of the Navy are for the calendar year 1930.

*Annual health examination.*—Of the 9,286 officers examined 45.9 per cent showed defects worthy of note. Most of the defects were of a trivial nature and were not such as to disqualify officers for the performance of their duties. As in previous years, the two most common defects were errors of refraction and overweight.

Practically the same defects occupied the first 9 places as in the 1930 examination.

Defects found in more than one-half of 1 per cent of officers are listed below:

	1931	1930	Order of frequency, 1930
Error of refraction.....	22.4	24.9	1
Overweight.....	10.0	17.4	2
Underweight.....	8.6	10.8	3
Defective hearing.....	7.2	6.9	5
Deviation, nasal septum.....	3.2	8.4	4
Hemorrhoids.....	2.6	2.3	7
Tonsillitis, chronic.....	2.2	1.0	10
Hypertrophied turbinate.....	1.9	3.4	6
Defective color perception.....	1.9	1.0	9
Varicocele.....	1.3	.6	14
Varicose veins.....	1.3	.4	17
Flat foot.....	1.1	.5	16
Hernia.....	.8	1.2	8
Albuminuria.....	.8	.6	13
Cardiac arrhythmia.....	.7	.5	15
Tachycardia.....	.6	.9	12
Trichophytosis.....	.5	1.0	11

*Death rate.*—A total of 389 deaths occurred, making the death rate from all causes 3.31 per 1,000.

This is lower than any previous rate since 1913, except 1922 and 1926 when the rate was 3.23 and 3.03, respectively. The median rate for the preceding five years is 3.60, and for the 5-year period 1920–1924 is 4.18. The death from injuries and poisons has exceeded

that from diseases during each year since 1922. This year the death rate for injuries and poisons was 2.06 and for diseases 1.53.

Drowning, usually the leading cause of death, dropped to second place with a lower rate than any preceding year since 1887, the first year in which complete statistics were published in the Annual Report of the Surgeon General.

The leading causes of death for the last three years are shown in the following table:

*Leading causes and number of deaths*

	1930	1929	1928
Motor vehicle accidents.....	58	48	52
Drowning (all causes).....	37	50	72
Suicides.....	32	29	35
Tuberculosis.....	28	22	23
Diseases of circulatory system.....	17	27	16
Appendicitis.....	14	9	13
Pneumonia.....	14	15	37
Cerebrospinal fever.....	11	20	27
Poisoning.....	11	14	12
Neoplasms.....	8	13	17
Abscess.....	7	8	7
Syphilis.....	7	9	9

*Flight hazards.*—There has been an almost progressive decline in aviation fatalities per unit of flying hours during the last 10 years. The following table shows the fatalities per 10,000 flying hours since 1920:

1921.....	9.8	1926.....	2.3
1922.....	3.8	1927.....	2.5
1923.....	3.2	1928.....	1.5
1924.....	6.9	1929.....	1.0
1925.....	3.7	1930.....	0.9

*Morbidity rates.*—There were 29 different conditions, each of which caused more than 10,000 sick days during the year. They are listed below in the order of frequency of admissions. It is noted that, with the exception of malaria for 1929, the same nine conditions caused each more than 1,000 admissions for 1929 and 1930.

	1930		1929	
	Admis- sions	Sick days	Admis- sions	Sick days
Gonococcus infections.....	8,659	123,737	8,776	121,585
Catarrhal fever.....	8,188	49,712	9,138	56,273
Injuries and poisonings.....	7,240	154,340	6,969	145,532
Tonsillitis.....	4,957	67,655	5,935	76,803
Chancroid.....	4,033	17,319	3,580	16,867
Syphilis.....	2,940	66,470	2,540	55,229
Cellulitis.....	1,882	23,364	1,826	23,238
Appendicitis.....	1,585	48,809	1,511	45,983
Bronchitis.....	1,141	28,690	1,136	30,971
Redundant prepuce.....	883	13,331	769	10,248
Vincent's angina.....	845	12,930	867	10,947
Gastritis.....	604	12,182	539	10,494

	1930		1929	
	Admis- sions	Sick days	Admis- sions	Sick days
Bubo, nonvenereal.....	537	18,583	427	12,648
Hemorrhoids.....	507	11,580	502	10,907
Trichophytosis.....	495	16,236	539	16,760
Malaria.....	447	12,337	1,235	39,147
Deviation, nasal septum.....	461	12,039	559	14,409
Otitis media.....	441	14,722	532	16,335
Cholangitis.....	433	10,910	565	12,417
Hernia.....	415	23,593	398	23,048
Arthritis.....	304	20,573	350	26,253
Pneumonia.....	253	12,300	206	12,090
Tuberculosis.....	225	45,451	206	40,339
Absence, acquired, teeth.....	190	13,384	193	12,815
Psychoneuroses.....	166	19,113	156	15,514
Pleurisy.....	160	10,081	162	14,927
Ulcer, duodenum.....	100	12,523	122	11,733
Chancroidal lymphadenitis.....	80	12,655	72	10,417
Dementia praecox.....	69	25,870	70	18,336

With the exception of catarrhal fever for 1930, it is noted that the same five conditions caused each more than 50,000 sick days during each of the last four years, and appear in almost the same order for the four years.

	Sick days			
	1930	1929	1928	1927
Injuries and poisonings.....	154,340	145,532	150,307	145,656
Gonococcus infections.....	123,737	121,585	111,634	108,354
Tonsillitis.....	67,655	76,803	75,022	77,855
Catarrhal fever.....	49,712	56,273	71,963	55,887
Syphilis.....	66,470	55,229	60,398	60,188

*Administration of arsenicals in the treatment of syphilis.*—There has been a gradual increase in the use of arsenicals since 1925, as shown in the accompanying table. The syphilis rate, however, showed a decline during the previous three years (24.57, 22.69, and 21.64 admissions per 1,000 men), although somewhat higher for the period covered by this report (25.03).

	Number of injections			Number of injections	
	Arsphena- mines	Tryparsa- mide		Arsphena- mines	Tryparsa- mide
1925.....	47,717	1,160	1928.....	80,000	2,551
1926.....	63,163	1,232	1929.....	83,041	2,383
1927.....	74,478	2,054	1930.....	88,460	4,418

#### CORRECTIONS

In the article Effects of Super-high-frequency Radio Current on Health of Men Exposed under Service Conditions, by Doctors Bell and Ferguson, which appeared in the July, 1931, Bulletin, several



errors occurred. The authors desire to call the reader's attention to these errors which are listed below:

Page 544, Table I, last column, under "and—" add "and x."

Page 544, Table I, first column, "Blood indican qualitative" should read "Blood indican quantitative."

Page 545, Table I, first column, "Microorganisms" should read "Microscopical."

Page 545, Table I, first column, "Mogalocytes" should read "Megalocytes."

Page 547, second note under Table II, Section I, "while mouth temperature is normal" should read "while mouth temperature is 98.6."

Page 549, eighth note under Table II, section 2, "Column D-3—" should read "Column DR-3—."

Page 551, sixth note under Table II, section 3, after "Practically no sweating during test" strike out "(Naturally sweats practically none)."

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#### NAVAL MEDICAL OFFICER AWARDED NAVY CROSS

On July 18, 1931, Capt. Lucius W. Johnson, Medical Corps, United States Navy, was awarded the Navy cross for his service in Santo Domingo following the hurricane of September 3, 1930. The citation is given in the following letter which accompanied the Navy cross.

THE SECRETARY OF THE NAVY,  
*Washington.*

SIR: The President of the United States takes pleasure in presenting the Navy cross to Commander Lucius W. Johnson, Medical Corps, United States Navy, for services as set forth in the following citation:

"For distinguished service in the line of his profession. He took charge of the entire medical and surgical situation in the Dominican Republic immediately following the disastrous hurricane of September 3, 1930. He gave himself indefatigably to the work of organization and direction, dedicating his recognized capacity to the organization of hospitals, distribution of food, improvement of sanitary conditions, and clearing away of the ruins. By his ability, zeal, energy, and devotion to duty, the organization perfected by him carried on so efficiently that probably no disaster of such magnitude ever had so slight an aftermath."

For the President.

ERNEST LEE JAHNCKE,  
*Acting Secretary of the Navy.*

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#### SHIP FUMIGATION

Writing on "Some aspects of ship fumigation" in the July 3, 1931, issue of Public Health Reports, J. R. Ridlon, surgeon, United States Public Health Service, makes the following interesting comments:

\* \* \* The use of suitable cyanogen products has practically replaced the use of sulphur in fumigation at all of the quarantine stations of the larger ports.

Several cyanogen products have been used at San Francisco during the past few years. These, together with the methods, include the following:

1. The generation of straight hydrocyanic-acid gas by a mixture of sodium cyanide, sulphuric acid, and water.
2. The generation of hydrocyanic-acid and cyanogen-chloride gas by a mixture of sodium cyanide, sodium chlorate, hydrochloric acid, and water.
3. Liquid hydrocyanic acid with either cyanogen chloride or chloropicrin as a warning gas.
4. Zyklon-B, which consists of an earthy substance impregnated with liquid hydrocyanic acid and marketed at present with 5 per cent chloropicrin as a warning gas.

The two latter methods of fumigation afford a saving in time and labor and have almost entirely displaced the generation methods at the San Francisco station. Generation of cyanide gas on shipboard with the use of crocks and barrels was a laborious process.

Under safety measures attention is called to the following:

Gas masks must be worn by fumigators when in any way exposed to the fumes of cyanide gas in dangerous concentration. This is necessary when opening cans of Zyklon-B, when dosing compartments with liquid cyanide, and when opening up compartments for ventilation. The canister attached to the mask is charged with chemicals which neutralize hydrocyanic-acid and cyanogen-chloride gas. These absorbent chemicals are a caustic silicate and an impregnated charcoal. They offer little resistance to breathing and are effective for several hours' use. The absorptive and neutralizing capacity of the canister becomes exhausted gradually, so that ample warning is given to replace the worn-out canister.

Two men should always work together in any place where there is danger from gas, such as in the holds or in compartments not immediately adjacent to an exit.

Test animals, such as rats or guinea pigs, should always be lowered into holds following fumigation, to test for the presence of gas in dangerous quantity before the fumigator himself goes below to make the final inspection.

Hydrocyanic-acid gas is one of the most deadly gases known and should be used with great care and caution. A person exposed for a short period to a strong concentration of cyanide gas, even though wearing an efficient gas mask, will suffer a marked effect from the gas. This is probably explained by absorption through the clothing and moist skin.

As to the comparative merits of liquid hydrocyanic-acid gas and Zyklon-B it is stated:

At present the cost of liquid hydrocyanic acid with 5 per cent chloropicrin is slightly less than that of Zyklon-B.

The two fumigants possess equal lethal power. They are both convenient to use and require an equal number of fumigators on shipboard. In dosing the holds it is necessary only to open a valve when using the liquid gas; and the new cylinder which delivers small accurate doses is convenient for use in small rooms.

In using Zyklon-B it is necessary only to knock holes in the cans and sprinkle out the contents. The empty cans are thrown away.

The preparations for the use of liquid gas require a little more attention, as the dosing cylinders must be accurately checked, weighed, and filled with compressed air before proceeding to the vessel.

At a station where there is regular routine ship fumigation and cylinders of liquid gas can be received at frequent intervals, this fumigant is very satisfactory. Loaded cylinders, however, should not be stored with air pressure applied, as there may be a degree of deterioration of the gas.

If only infrequent fumigations are done, Zyklon-B would be very satisfactory, as this material can be stored for a longer time before use.

The opening of many small cans of Zyklon-B in a closed space is attended with danger from absorption through the clothing, especially if fumigators are perspiring. In using liquid gas the operator need not be in intimate exposure to the applied gas.

It is found that a combination of the two methods makes an ideal way of fumigation. It is common practice at this station to use both methods in combination on the same vessel.

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#### SOME MEDICAL ASPECTS OF AN ISOLATED RADIO STATION

Numerous small stations throughout the service ashore and afloat include a so-called "independent duty" Hospital Corps man among the personnel as provision for the sanitary and medical requirements. The competence of these carefully selected men in carrying on routine and meeting emergencies has been proven over and over again and in isolated places a great deal is asked rather than expected. By and large much that is creditable is accomplished by these men in the exercise of commendable discretion, judgment, and intelligence. Many no doubt wonder what goes on in the more isolated of these assignments and few of us have opportunity to satisfy our curiosity. The following from the interesting report of Chief Pharmacist's Mate M. B. Folb, United States Navy, is, therefore, the more interesting, and the account of his experience is given to the readers of the Naval Medical Bulletin. What is characterized as "first aid" will be seen to have been rather comprehensive attention.

In addition to his regular duties Chief Pharmacist's Mate Folb was called upon to take care of a number of emergency cases occurring among the civilians living in the vicinity of the station.

These cases included: (1) A primipara, giving a history of a recent complication; (2) a secundipara, with a history of a previous instrumental delivery and eclampsia; and (3) a tertipara, who, during labor, had a systolic blood pressure of 240 m.m. and a urine strongly positive for albumen. All three cases were successfully delivered.

In addition to the obstetric cases, several cases of severe burns required attention. One case was that of a boy 5 years of age. Approximately one-half the body was covered with burns of the third degree. When first seen the pulse was 150, temperature 104° F., and the respiration 40. Recovery was extremely doubtful. However, the child responded so well to the treatment given that in six

days the improvement permitted sending him to a distant hospital by airplane.

For the efficient manner in which he handled this case Chief Pharmacist's Mate Folb received a letter of commendation from the Bureau of Navigation.

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CONTROVERSIES ON YAWS—SYPHILIS RELATIONSHIP AND ORIGIN OF SYPHILIS

The reader will recall that in the Naval Medical Bulletin of October, 1931, there was reproduced a series of letters on yaws and syphilis which appeared in the Lancet between April 25 and July 4, 1931.

The following letter of Doctor Stannus published in the Lancet of July 4, 1931, however, was not included and is given here to complete the correspondence as it appeared in the Lancet:

TO THE EDITOR OF THE LANCET.

SIR: It must be obvious that there is little to be gained by further correspondence upon this subject; the problem is too big a one to thrash out in these columns. Any reader of the Lancet who has the time and opportunity of studying the literature of the subject and the diseases themselves, with care in interpreting the terms used and in deciphering the sequence of manifestations, and with due regard to the sources whence the older writers derived their information, and to the general trend of medical opinion of their times, must form his opinion. He may find himself unable to come to a definite conclusion in regard to the relationship of yaws and syphilis, but I have little doubt he will agree with me that sabbens (and other outbreaks of disease mentioned by me in a previous letter) was certainly not yaws, but was epidemic, for the most part nonvenereal syphilis, not always nonsexually acquired as Doctor Burke asserts.

I must, however, allude to a previous letter by Captain Butler to correct a statement which he makes in regard to my criticism of Lancereaux, an eminent syphilologist who had never seen yaws. I had said "Lancereaux was not even aware that pian and yaws referred to the same lesion." Lancereaux's words are: "There afterwards appear in different parts of the body, in pian little red pimples, in yaws papules and pustules, which soon became covered with uneven crusts beneath which are more or less extensive ulcers"—thereby distinguishing wrongly pian from yaws, though grouping them together as belonging to the domain of syphilis, this idea being based upon the garbled accounts of framboesia he had received, and the false belief that the disease was transmitted hereditarily. I suggested that Captain Butler had been unhappy in the sources of his inspiration in regard to yaws. Later he has cited Huxham, Sydenham, and Buchan as "aware that yaws was simply nonvenereal syphilis." Does Captain Butler really subscribe to such a view? Has anyone in this country seen an extragenital chancre followed by a typical eruption of yaws? May I take this opportunity of asking any of your readers who has at any time under his observation a case of syphilis exhibiting what has been termed a framboesiform syphilide, to give me the opportunity of seeing the case.

Captain Butler has also been unfortunate in following Jonathan Hutchinson in his opinion in regard to the case reported in the Lancet 30 years ago. Hutchinson was guilty in just the same way as older syphilologists, as was pointed out

by Patrick Manson in the discussion. I think I might go further and suggest that Captain Butler appears to have been equally unfortunate in his clinical material. In a recent paper (*International Clinics*, 1930, vol. ii), he figures a Javanese child exhibiting (let me say for the benefit of those unacquainted with yaws) the common absolutely typical eruption of framboesia; but his own note about the case reads: "This is what is called for by textbooks in their definition of yaws, but is rarely seen." If Captain Butler will study the disease in Africa or the Dutch East Indies he will be surprised to see the disease, apparently unfamiliar to him, as recognized and described by clinicians as a clinical entity, whatever its relationship to syphilis may prove to be in the future. He will then understand why I suggested that the "dualists" would have good reason in throwing the onus of proving them wrong upon Captain Butler, a suggestion which appears to have caused him pain.

I am, sir, yours faithfully,

HUGH S. STANNUS.

Wimpole Street, W., July 1, 1931.

Captain Butler's final reply in the controversy, which was not a part of the *Lancet* correspondence, follows:

"It cramps the physician's capacity for inductive reasoning, so cherished by Hippocrates, if he is to be mentally manacled by the fallacy of the American origin of syphilis." (Reltub.)

As will be seen from his letter, Doctor Stannus attempts further to mutilate Lancereaux's meaning, which could have been cleared up completely if his full paragraph had been quoted. It would have been evident that although the terms pian and yaws were considered as part of framboesia, there was a shade of difference connoted by the terms which the older writers considered valid. As pian is a French word, it is very likely that Lancereaux, a Frenchman, knew the shade of meaning it conveyed at that time. In proof of this, we will quote the full paragraph of which Doctor Stannus quotes only the part which suits his purpose.

The yaws begins by a state of languor and weakness, pains in the joints, sometimes fever, especially in children; pian generally presents the same initial symptoms. There afterwards appear in the different regions of the body, in pian, little red pimples; in yaws, papules and pustules, which soon become covered with uneven crusts, beneath which there are more or less extensive ulcers. *These ulcers, which coexist with voluminous common tubercles, to which latter is due the name of yaws, are sometimes raised, bleed at the slightest touch, and are followed by a scar.* (Italics of C. S. B.) After pian is observed, amongst other lesions, the affection of the bones characterized by wandering osteocopic pains, exostoses, etc.

The Oxford English Dictionary defines pian thus:

Pian—Also eplan, and in pl. plans. (= Sp., Pg. eplan and pian, F. pian, a. Galibi (Rio de Janeiro) pian (Roulin in Littré, suppl.) Cf. Guarani pia "bubas, granos" (Montoya). Cf. Jas. Platt in N. & Q. 10th ser. I 5.) A contagious tropical skin disease, occurring among negroes, the same as framboesia or yaws, q. v. (The names plans and yaws have occasionally been applied to two alleged forms of framboesia. See quotes.) Hence Pianic a. (1768 F. B. De

Sauvages Nosol. Method II 554 Framboesia; Yaw Guineesium; Eplan vel Plan Americanorum). 1803 T. Winterbottom Sierra Leone II. viii 139 the Yaws . . . is called by the Portuguese on the coast boba and by the French planes. Ibid. 145 Professor Sprengel has made a similar division of this disease into yaws and plans. 1874 T. H. Burgess Man, Dis. Skin 233, the American disease called plan or eplan seems to be identical with that denominated yaws in New Guinea. 1828 Lancet 15 Mar. 876/1. The planic ulcers . . . furnish acrid matter.

This distinction was what Lancereaux was attempting to bring out in the paragraph which I have quoted. Doctor Stannus is evidently unaware of the fact that the older writers made such distinction. The distinction is not to be wondered at, however, because, while the modern textbooks on tropical medicine in their treatment of yaws refer to the framboesioma as typical of yaws eruptions, they also describe all the other skin lesions of syphilis as a part of this *impossible entity*.

In the above quotation Doctor Stannus makes the statement that Lancereaux had never seen yaws. Where he gets his authority for this is not apparent, as Lancereaux does not make any such statement in his discussion of yaws. However, he was so experienced with syphilis that he had an understanding of all its forms of eruption, a remark which, quite evidently, is not true of Doctor Stannus.

Doctor Stannus refers to the sentence in one of my Lancet letters in which reference was made to the fact that Huxham, Sydenham, and Buchan were "aware that yaws was simply nonvenereal syphilis." He then asks, "Does Captain Butler really subscribe to such a view?" The question is equivocal. If he means to question whether the authors mentioned held the views which I attributed to them, then he may verify my statement by the following references: (1) Case report by John Huxham in 1739, Philosophical Transactions XLI, 667; (2) Sydenham's Works as edited by John Swan, third edition, pages 335 and 336; (3) Domestic Medicine by William Buchan, M. D., F. R. C. P. Edinburg, edition of 1789. On page 518 of this volume, Doctor Buchan states that yaws and sibbens or sivvens are species of the lues venerea. Now if Doctor Stannus's question has the alternate meaning that could be attached to it, that is to say, "Does Captain Butler really subscribe to such a view" as that "Yaws is simply nonvenereal syphilis," the answer is yes, that is precisely what I believe with this proviso, yaws is often a *venereal disease*, but the filthiness of personal habits of those who may foster yaws leaves little chance, certainly in the tropics, for a child to grow to the age of sexual maturity without acquiring innocent syphilis (yaws) which renders him immune usually to subsequent sexual acquisition of it. In further explanation of this phase of his question, I will say that Doctor Stannus in his Lancet letter of July 4, 1931, refers to an article published by me in the International Clinics,

Volume II, June, 1930, and says that if Captain Butler had studied the disease in Africa he would have seen more of such cases as pictured in the frontispiece of that journal. I take it that he does not mean to intimate that Africa and Dutch East Indies are the only two sections of the world that now harbor yaws. So that his remarks in this connection are irrelevant. They prove nothing and so far as I can see are meaningless, as is also his reference to Jonathan Hutchinson. If he had *read* my paper, which he criticizes above, he would have no doubts of my meaning.

From the above it will be seen that the author was hard pressed for ammunition in the Lancet discussion, and it is little wonder that he opened this particular number with the observation "it must be obvious that there is little to be gained by further correspondence upon this subject." The idea being that if the Lancet readers did not accept *his* definitions and statements that there was no use going any further with the matter.

In the course of the Lancet correspondence upon this subject, it was a source of surprise to me to note that Colonel Burke to whose initiate eyes, "The faintest streak that on a petal lies," speaks instruction, could be led into such inconsistencies as are evident in his several letters. He has proved to his own satisfaction that "yaws, sibbens, boubas, pian, radesyge, and parangi are synonymous." Doctor Stannus proved on his part that sibbens was "epidemic, for the most part, nonvenereal syphilis." So that between the two they have shown that yaws is syphilis, which was the proposition to be demonstrated.

The Lancet correspondence reproduced in the October, 1931, Bulletin and finished herewith has brought out several features which it is good that physicians generally should know about. The arguments advanced by the proponents of the theory that yaws is a distinct disease are in no wise different from the arguments advanced by all those who have held these views during the past 50 years. The "framboesiologist" when cornered will always argue that it takes "an expert" to recognize yaws and will say that the fellow on the "unity" side of the argument is never an expert. So in Doctor Stannus's arguments, Sir Jonathan Hutchinson, Berkeley Hill, Professor Lancereaux, and Captain Butler have been "unfortunate" in the material studied, etc. It would seem quite clear that the "framboesiologists" are contaminating the "youth of medicine" with their strained ideas and views about yaws. Their strivings represent the last desperate effort to keep life in the "yaws body" by artificial respiration and blood transfusion. Perhaps it might be better to say that they represent a laudable desire to have the corpse take on a lifelike appearance.



**ORGANOTHERAPY IN ADDISON'S DISEASE**

Rowntree and Snell in their work "A Clinical Study of Addison's Disease," Mayo Clinic Monograph, 1931, state:

The present status of cortical extracts deserves mention, since it is possible that from studies with these substances the cure or control of Addison's disease will come \* \* \*.

Without discounting the value of studies on extirpation of the gland and on the preparation of glandular extracts, it must be said that the exact physiologic functions of the suprarenal gland in the intact animal are uncertain. Our exact knowledge of the physiology of the suprarenal glands can be expressed in two statements: The cortex of the gland is essential to life, and the medulla of the gland, although apparently not a vital organ, secretes a substance which is normally present in the blood stream and which has powerful pharmacodynamic properties. Of the multitude of other functions which have been suggested, few rest on adequate experimental grounds \* \* \*.

The Muirhead treatment, as now employed, must be adapted to the individual patient. The preparation of whole gland has been replaced by the dry cortex, which was prepared and furnished to us for experimental purposes by Parke, Davis & Co. Both of these preparations seem to cause gastrointestinal irritation at times, the whole gland apparently more than the cortical preparation. In addition to the above epinephrine, hypodermatically and by rectum, is given three times a day.

The limitations of the Muirhead treatment should be faced squarely. It is only a form of substitution treatment. It has to do purely and solely with an attempt to give to the body products which ordinarily come to it through and from the suprarenal glands. In Addison's disease, because of disease or absence of the glands, this is not supplied in normal or adequate amounts. This treatment is entirely devoid of any effect on the disease underlying the failure of the glands and can not be thought to affect the pathologic process in the glands, tuberculosis, or syphilis. The treatment may, however, be of true value in meeting the need created by complete or partial failure of the gland to supply suprarenal products. We believe that it has done this effectively over months, and even over years, in certain selected cases, or at least that it has tided the patient over a critical period until the glands have been capable of carrying on a greater amount of work. Unquestionably the treatment has been responsible for saving life, temporarily at least, in a considerable number of cases \* \* \*.

\* \* \* Extensive experience in the use of the so-called Muirhead treatment for patients with Addison's disease has convinced us of the futility of ordinary therapeutic measures in combating the crisis of acute suprarenal insufficiency which develop in the course of this disease and of the great need for a more active cortical preparation which could be administered either hypodermically or subcutaneously \* \* \*.

\* \* \* Our experiences thus far lead us to believe that the cortical hormone of Swingle and Pfiffner constitutes a valuable addition to the treatment of Addison's disease.

\* \* \* The cortical extract of Swingle and Pfiffner is not available commercially. The problem of the preparation of an active, accurately standardized commercial product that will be acceptable to the council of pharmacy and chemistry of the American Medical Association is being studied at present. When this problem has been solved a more accurate appraisal of the thera-

peutic value and indication for the use of this suprarenal extract will be possible.

It would seem, however, that a new era has arrived, and that the long-awaited active cortical hormone is at hand. This holds promise of real and substantial progress in the treatment of the disease. The results to date would seem to indicate that the patient dying of Addison's disease falls short of good health only through the lack of a little cortical hormone. Even in this we can not be too hopeful, since at best an active principle can be of value only for substitution or replacement therapy and can hardly be expected to check the course of active tuberculosis. The coexistence of tuberculous processes, with functional failure, in a small, vital, and irreplaceable organ offers a truly difficult problem.

In a footnote the authors add:

Since the preparation of this report we have had the opportunity of using hexuronic acid, isolated from the cortex of the suprarenal gland by Szent-Györgyi, in two cases in which vomiting and anorexia were marked and the concentration of blood urea was 125 mg. in each 100 c. c. Both patients responded well during the time that hexuronic acid was being used, although solutions of glucose and sodium chloride intravenously also were given. Possibly a slight decrease in cutaneous pigmentation was noted in one case \* \* \*.

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#### PREVENTIVE VACCINATION AGAINST TUBERCULOSIS

Investigators are constantly searching for a method of producing a specific immunity to tuberculosis which can be safely applied for practical use in children.

A vaccine for this purpose, which has for some years received considerable attention in the foreign medical journals, is one made from attenuated bovine tubercle bacilli (Calmette-Guerin bacillus), known as the B.C.G. vaccine.

In France this vaccine has been distributed by the Pasteur Institute, and cultures of the organism supplied to foreign laboratories.

Commenting on the value of this vaccine an editorial in the British Medical Journal of June 20, 1931, states:

\* \* \* Professor Calmette has failed by his animal experiments to convince the bacteriologists, and by his human experiments to convince the statisticians. His logic is excellent, but his premises are unproven \* \* \*.

\* \* \* First of all, "Is it possible to produce by artificial methods a significant degree of immunity to tuberculosis?" There are certain diseases, of which the most important belong to the filterable virus group, which leave behind them a comparatively solid immunity. Second attacks of smallpox, measles, poliomyelitis, or distemper, for example, are uncommon, and against certain of these diseases it has proved possible to prepare a vaccine which can give rise to a definite and fairly lasting increase in the resistance of normal subjects. The immunity conferred by vaccination is rarely as sound as that resulting from a natural attack of the disease, and is by no means absolute. Vaccination against smallpox, for example, unless recently performed, does not afford certain protection against infection, though it diminishes the severity of the attack and lowers the case-mortality rate. On the other hand, there

are diseases, of which tuberculosis and syphilis are outstanding examples, which leave behind them only a very slight degree of immunity. Second attacks of clinical tuberculosis are not only not uncommon, but they are, in fact, very frequent. That is to say, infection with the fully virulent bacilli may fail to produce anything but a slight and transitory increase in resistance. Is it likely, therefore, that vaccination with an attenuated virus is going to be any more successful? \* \* \*. On purely *a priori* grounds, we may conclude, therefore, that no form of artificial immunization against tuberculosis is ever likely to produce a higher degree of immunity than that which can be produced under the most favorable natural conditions \* \* \*.

Secondly, "Has it in fact proved possible to produce an immunity to tuberculosis?" According to Calmette more than a million children have been vaccinated with B.C.G. in the last seven years or so \* \* \*. The fallacies in the French figures can not be considered here in detail; suffice it to say that the groups of vaccinated and of nonvaccinated infants have not been comparable, and that the estimate of mortality which would have occurred in vaccinated group, if vaccination had not been performed, has been based on assumptions for which there is insufficient justification. No simple criterion for assessing the value of the vaccine is available. Reduction of the death rate from tuberculosis during the first year of life among the general population is too crude a measure to employ; for, as Wolff points out, tuberculosis now contributes such a small proportion of the total deaths, that if every single death from tuberculosis in the 0-1 year age group in Berlin could be prevented, the infantile mortality rate would drop only from 78 to 76.4 per 1,000. A fall in the infantile mortality rate from all causes, which Calmette asserts to be one of the main benefits of B.C.G. vaccination, is difficult to interpret for the same reason \* \* \*.

Thirdly, "Even if it should be firmly established that B.C.G. was capable of producing an appreciable degree of immunity, would it be wise to advocate its general adoption?" \* \* \*. When it is considered that whatever protective effect B.C.G. may have probably wears off in the course of a year or two—Professor Calmette is now recommending revaccination at 3, 7, and 15 years—and that for a month or longer after vaccination the infant must be carefully isolated from every possible source of tuberculous contamination, it will probably be agreed by most workers that any general adoption of vaccination would be highly inexpedient. The case with infants who are born of tuberculous parents, and who must unavoidably be exposed to frequent and often heavy infection during the first few months of life, is on a different footing. We are strangely ignorant of the real risk incurred by such children, but it is legitimate to assume that it will be greater than that of children reared by healthy parents. The prophylactic vaccination of such infants might conceivably convey sufficient immunity to turn the balance in favor of the child, and it is for such a class that vaccination should be reserved. Even then it should be employed only *faute de mieux*; the correct way to deal with these infants is to remove them to a healthy environment as is being carried out under the highly successful Grancher system in France.

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#### AVERTIN AND ITS USE IN TETANUS

In the April 9, 1931, number of the New England Journal of Medicine appears an editorial under the above heading. The information is of such practical value that the editorial is quoted in full:

Tetanus is usually considered a fatal disease when it reaches a stage where the nervous system is seriously involved by the toxin, and treatment with the specific antitoxin, at this time, has proved to be relatively inefficient. This is partly due to the fact that intravenous and intraspinal methods of administering the antitoxin are largely precluded on account of the hypersensitiveness of the patient; even the least touch often throws the patient into a violent spasm, sometimes so severe as to cause death. Recourse has usually been had, during the spasms, to drugs such as chloroform and it has been the drug of choice for many years. The results of treatment by this method, however, have been so disastrous that one looks forward with pleasurable anticipation to the advent of new preparations which may be used at a time when the disease is well established.

Of the newer anæsthetics the most prominent are amytal and avertin. Amytal has been used in the treatment of tetanus, but not very successfully. Its dangers need not be considered here. Avertin, however, a drug synthesized as a chemical curiosity in 1922, has found a more definite place in the treatment of this disease. As a general surgical anæsthetic, at least 250,000 cases have been published and reports of its use in tetanus are now appearing in medical literature. Recently, of 11 cases noted in Germany, 7 recovered, and it would seem, although we are not yet in a position definitely to evaluate the worth of avertin in tetanus, that a valuable therapeutic aid has been given to us.

In view of the few reports in the American literature, attention is called to the following account from the Yale University School of Medicine by Huntington.<sup>1</sup> The patient, a boy of 11, was seen in a typical spasm. Avertin, 100 mg. per kilo, was administered by rectum, with immediate relaxation of the spasm. At the same time, antitoxin was given both intraspinally and intravenously. Avertin was continued at the rate of 80 mg. per kilo, twice a day, for 10 days, and then once a day for a few days longer. During its administration there was no depression of either the blood pressure or the rate of respiration. Huntington's patient made a normal convalescence and recovery was complete. The drug was not habit-forming. In addition to reporting the details of a single case, Huntington gives a good review of the literature on tetanus. He considers that avertin may prove an important addition to antitoxin as a means of treating this disease.

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#### NEW MENINGITIS ORGANISMS DISCOVERED

A new group of epidemic cerebrospinal meningitis germs has been discovered at the National Institute of Health at Washington during studies conducted under the direction of the United States Public Health Service. This is the fifth group of these dangerous germs to become known.

During the last five years there has been more of this infectious disease in the United States than at any time since the World War. A wave of epidemic cerebrospinal meningitis has traveled slowly across the United States from the Pacific coast, Dr. Sarah E. Branham, engaged in meningitis research at the National Institute of Health, said in remarking on the discovery. This wave manifested itself in several outbreaks in many centers of population—as, for

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<sup>1</sup> Huntington, Robert W., jr. *Yale Jour. Biol. and Med.* 3: 207, 1931.

example, in Salt Lake City, Chicago, Memphis, Detroit, Indianapolis, Philadelphia, and New Haven.

The new group of meningitis germs was found while Doctor Branham and her coworkers were endeavoring to find an improved serum for the treatment of this disease. They were engaged at the time in examining more than 400 cultures from epidemic cerebrospinal meningitis collected from various sections of the country where flare-ups had appeared.

Outbreaks of cerebrospinal meningitis often seem to be spontaneous and are sometimes widely separated, Doctor Branham pointed out, because only a few individuals out of many persons who may carry the germs of spinal meningitis in the respiratory tract actually may contract the disease. These carriers, though, may spread the infection.

The germs of this disease are grouped according to "strains." Not all strains are alike in their power to produce the disease. Some are very virulent and deadly and more apt to cause a fatal form of the disease than other strains. More than 50 per cent of the cases in the recent epidemics of cerebrospinal meningitis have been fatal in some localities, while in other cities the deaths have been fewer.

Although primarily a disease of children, epidemic cerebrospinal meningitis affects adults also, especially those living under crowded conditions and following a radically changed routine of life. Such conditions aided widespread and fatal outbreaks of epidemic cerebrospinal meningitis during the World War among soldiers encamped in this country and abroad.

Although the "meningococcus," as this germ is called, was discovered by Weichselbaum in 1887, the fact that all strains were not alike was first recognized by the French bacteriologist, Dopter, in 1909, and recognition of the first four groups of cerebrospinal meningitis germs was made by Dr. M. J. Gordon, a British physician, and his coworkers, during the World War. The majority of the "strains" sent to the National Institute of Health during the recent epidemics in the United States have been found by Doctor Branham and her associates to fall into the four groups of Gordon. The new fifth group has been found to be predominant in some parts of the Middle West.

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#### FLY LARVAE IN TREATMENT OF CHRONIC OSTEOMYELITIS

Dr. William S. Baer in an article, "The treatment of chronic osteomyelitis with the maggot (larva of the blowfly)," which appeared in the *Journal of Bone and Joint Surgery* of July, 1931, gives the following conclusions which are quoted in full:

1. Maggots have been found to be a tremendously useful adjunct to thorough surgical treatment of chronic osteomyelitis, and, in our opinion, are far more

successful in securing permanent healing of these extensive wounds than any other method tried by us.

2. Maggots, by their digestive action, clear away the minute fragments of bone and tissue sloughs caused by operative trauma in a way not accomplished by any other means. This is a tremendously valuable asset in the healing of a wound.

3. Maggots cause wounds to become alkaline and in this way diminish growth of pathogenic bacteria.

4. Maggots seem to have other more subtle biochemical effects within the wound itself and perhaps cause also a constitutional reaction inimical to bacterial growth. This is under investigation.

5. Maggots as raised and sterilized in the manner described may be used in any wound without risk to the patient.

6. The post-traumatic or postoperative general condition of the patient is better in maggot treatment than in the older forms of treatment where infection was combatted by chemicals or other types of dressing. There is less absorption and less toxic reaction.

7. In open tuberculous abscesses, with or without secondary infection, wide exposure followed by maggot treatment has proved surprisingly effective in a small number of cases and will be given further trial.

Hyman I. Goldstein, M. D., writing in the same number of this journal, gives a historical review of the opinions on this subject among which the following are of interest:

Crile, speaking before the Clinical Congress of Surgeons of North America ("War session," October 23, 1917), said: "In the wounded who lie out in 'no man's land' for 2 or 5 or 10 days, it has been found that the wounds that have done best are those that contain maggots. The reason for this is that there is devitalized tissue; the maggots live on this devitalized tissue; and if they destroy that tissue they do in time what the surgical operation does."

Dr. Edward Martin of Philadelphia, formerly professor of surgery of the University of Pennsylvania, said before the same session of the Clinical Congress of Surgeons of North America, that they had "been advised by one eminent member of the profession to take all the antiseptics and throw them into the sea, and another had advised them to raise a brood of tame maggots to take care of the wounds."

W. W. Keen of Philadelphia (1918), says: "During the Civil War maggots were very common in the summer \* \* \* the resulting maggots were certainly disgusting, but, so far as I ever observed, they did no harm. Crile (1917) now says that, on the contrary, they actually do good. This would probably be especially true in cases of infection from bacillus of gas gangrene."

Dr. Goldstein concludes his paper with the following remark:

Whether this unique and ancient remedy (viable antiseptic) will become popular in America remains to be seen.

In the NAVAL MEDICAL BULLETIN of July, 1931, F. F. Murdoch, Lieutenant Commander, Medical Corps, United States Navy, and T. L. Smart, pharmacist's mate, first class, United States Navy, published the method employed at the United States Naval Medical School of producing sterile blowfly larvae for surgical use. Fly larvae for this purpose are now being supplied by firms specializing in biological products.

**PROPHYLAXIS OF RINGWORM OF FEET**

Earl D. Osborne and Blanche S. Hitchcock, Buffalo (Journal A. M. A., Aug. 15, 1931), report a method for the prophylaxis of ringworm of the feet which has proved satisfactory as judged by fungicidal tests in the laboratory and from practical experience in the high schools of the city of Buffalo and in many other public and industrial institutions. About a year ago it was suggested to one of them that it might be worth while to test out the fungicidal activity of sodium hypochlorite, the common, cheap, and harmless bactericide used in most city water supplies. They at once tested out the fungicidal activity of this chemical to five common types of fungi found on the feet of persons suffering from ringworm. From these tests it was evident that a solution of 0.5 per cent sodium hypochlorite should kill all the common fungi found in ringworm of the feet with exposure of 15 seconds to these organisms in a watery suspension. Fresh moist deposits of ringworm organisms on the feet should therefore be killed with 0.5 per cent solution hypochlorite, provided the organisms have not penetrated to the deeper cells in the horny layer of the epidermis. With the experimental data at hand, the T. A. Patterson Laboratories supplied the Buffalo high schools, at cost, with sufficient rubber pans and sodium hypochlorite solution to carry out this method of prophylaxis for a period of one year. The company had a special rubber pan prepared whose inside measurements were 2 feet on a side. These pans were made of heavy rubber and weighed approximately 60 pounds. One pan was placed on the floor of the corridor between the dressing rooms and the shower baths and another pan was placed at a point past which all the pupils had to pass just before putting on their clothes. The pans were filled up to the 2-inch mark with 0.5 per cent solution hypochlorite solution and this solution was changed every morning. Although the solution was never diminished to such an extent that a refill was necessary, it was evident that a large number of persons stepping in and out of the pan on the way to the shower bath might gradually deplete the solution. A slight, but not appreciable, dilution of the chemical occurred. In order to allow for this dilution and for a fair margin of error, the authors have recently recommended the use of 1 per cent solution hypochlorite instead of 0.5 per cent solution. Up to May 2, 1931, this method of prophylaxis has been employed in the Buffalo high schools for a period of from 9 to 12 months. The physical directors of each school have been carefully advised regarding the method and the checking of results. All the complaints have been transmitted to the director of physical education of the Buffalo public schools. He stated that in former years a great many complaints were received and that many new



cases of ringworm of the feet appeared each year among high-school students. The director of physical education of the public schools of Buffalo reported that this year he had not received a single complaint from parents or pupils because of the appearance of ringworm of the feet. The various directors of the different schools have been well informed on the disease and have been unusually alert in the detection of new cases. None were reported for the entire year. In private practice the authors have noticed a drop in the incidence of new cases of ringworm of the feet in high-school pupils of the city of Buffalo. Their records fail to show a single new case, although numerous ones have appeared from the surrounding towns.

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#### PROBLEM OF ARSPHENAMINE-RESISTANT SYPHILIS: CASE

Thomas H. Miller, Detroit (Journal A. M. A., July 4, 1931), reports a case of primary syphilis resistant to arsphenamine. The lesion healed after sulpharsphenamine and bismuth were given intramuscularly. The arsphenamine was carefully tested and proved to be trypanocidally active to a somewhat higher degree than that required by the United States Public Health Service. From the beginning, the patient showed a vascular instability and reacted badly to arsphenamine. The consensus at present holds the individual as the responsible etiologic factor in resistance to arsphenamine, although the mechanism of such resistance has not been settled. Arsphenamine-resistant syphilis may manifest itself in one or all of three ways: In the persistence of syphilitic lesions, in a persistently positive Wassermann reaction of the blood, or in the persistence of *Spirochaeta pallida* in the lesions while the patient is under what, in the majority of cases, is considered adequate arsphenamine therapy. According to reported cases, there is an apparent increase of arsphenamine-resistant syphilis in France and Germany. No such increase is evident in the United States, at least in the vicinity of Philadelphia and Baltimore, and the small number of reported cases would suggest that this is true of the country as a whole.

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#### BRONCHOSCOPY IN PULMONARY DISEASE

In an article entitled, "Bronchoscopy in the diagnosis and treatment of pulmonary diseases," which appeared in the Journal of the Indiana State Medical Association of July, 1931, Louis H. Clerf, M. D., professor of bronchoscopy and esophagoscopy, Jefferson Medical College, Philadelphia, Pa., states:

When discussing bronchoscopy it has been customary for the medical profession to think of foreign bodies in the air passages and to conclude that a

presentation on this subject would be of didactic interest only. Recent statistics of the bronchoscopic clinics show that the endoscopic procedures performed for foreign body constitute less than 2 per cent of the total number of examinations in spite of the fact that foreign body cases are twice as common as they were 10 years ago.

The greatest field of usefulness for bronchoscopy to-day is the diagnosis of obscure pulmonary disease and the treatment of certain well-defined conditions. Bronchoscopy, however, is the only method to be considered in the removal of foreign bodies in the air passages.

Among diagnostic problems probably no one condition presents greater difficulties in arriving at an accurate diagnosis than "bronchial obstruction." It is often easy to make a diagnosis of bronchial obstruction by physical examination and Roentgen studies. The cause of the obstruction must be determined, however, before appropriate treatment can be instituted. When one recalls that obstructions may be produced by congenital anomalies, foreign bodies, new growths, either benign or malignant, endogenous foreign bodies as broncholiths, inspissated or thick secretion, tuberculosis and strictures, as well as a number of extrabronchial conditions, the need for an etiologic diagnosis is apparent.

\* \* \* The foreign-body phases of the work have been overshadowed by the immense number of cases that are constantly being sent to the clinics for the diagnosis of obscure chest disease or for the treatment of known conditions which respond favorably to bronchoscopy. Bronchoscopy is to the internist and thoracic surgeon what cystoscopy is to the urologist and ophthalmoscopy to the ophthalmologist. It has done much to discourage inferential methods of diagnosis in pulmonary disease. It is one of the aids to diagnosis and treatment of chest conditions that should be available in every general hospital.

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#### FURTHER EXPERIENCES WITH NUPERCAINE

On the basis of their personal experience and of the one hundred and odd papers that have appeared since Miescher synthesized it from the quinoline nucleus, Edward L. Keyes and Allister M. McLellan, New York (Journal A. M. A., June 20, 1931), believe that, as compared to procaine, nupercaine shows the following characteristics: (a) Its toxicity in man is about twenty times as great. (b) The anesthesia produced is relatively slightly delayed, more intense, and from three to six times as lasting. (c) The detoxification of nupercaine in carnivora is almost as rapid as that of procaine. (d) In man the fall of blood pressure during spinal anesthesia by nupercaine is less than that from procaine and, when marked, is more immediate. (e) The minimum blood pressure under spinal anesthesia is registered within half an hour, no matter which drug is used. (f) With the doses employed by the authors in surface, local, block, or caudal anesthesia, nupercaine has not intoxicated any of their patients, though several of them had previously been intoxicated by procaine. (g) Nupercaine does not irritate the skin of the fingers nor cause onychia. Two deaths are reported after spinal anesthesia with nupercaine. The authors consider that the advan-

tages of nupercaine over procaine are greater than the disadvantages. They are not disposed to use a mixture of procaine and nupercaine.

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#### **OBSERVATIONS ON THIOCYANATE THERAPY IN HYPERTENSION**

William C. Egloff, Lyman H. Hoyt, and James P. O'Hare, Boston (Journal A. M. A., June 6, 1931), state that their results with thiocyanate therapy in hypertension, interpreted in the light of conservative control and with due consideration for the disagreeable symptoms produced, were so nearly uniform that they should at least serve as a warning against too great enthusiasm for this drug. Of 25 patients only 2 reacted favorably to the administration of sodium thiocyanate and even in these two the reaction was not particularly striking or different from what is seen in many other patients who have had no treatment whatever. In the remaining 23 cases, not only did the drug fail to lower the blood pressure or relieve the symptoms, but it produced very disagreeable side effects.

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#### **ANTERIOR PITUITARY HORMONE IN URINE**

Although the Aschheim-Zondek test appeared to be sufficiently accurate as an important diagnostic aid, Frederick Eberson and M. H. Silverberg, San Francisco (Journal A. M. A., June 27, 1931), felt that the time required for the test might be shortened appreciably and perhaps the accuracy increased in proportion. To this end, they studied several different procedures. The method they adopted and whose technic they describe is based on a simple procedure for concentrating the active substance in the urine, thus permitting injections of considerably more material in a small volume. This modification of the Aschheim-Zondek test has proved accurate and sensitive in the diagnosis of early pregnancy, including cases of ectopic gestation and missed and incomplete or complete abortion. The results in a series of 175 cases were free from error. Death of the fetus can be detected by this test in certain peculiar changes in the ovaries of rats viewed microscopically. These retrograde changes can be recognized and are diagnostic regardless of the misleading grossly positive appearance that may persist in the test animal as late as seven days after the death of the fetus in utero. The test has proved exceptionally valuable in medicolegal cases and is important in therapeutic abortion and in circumstances demanding a prompt diagnosis or exclusion of pregnancy. In the absence of macroscopic changes in the ovaries, the microscopic observations of peripheral organization of follicular cells and a peculiar vitreous alteration of

the central mass of cells is diagnostic of very early pregnancy or its arrest. Despite the absence of luteinization, these structural and tinctorial changes noted in the follicular cells are specific and especially valuable in conditions that preclude diagnosis from the macroscopic observations alone. Further modification of this method indicates that the diagnosis of pregnancy can be made within thirty-six hours after obtaining a specimen of urine for the test. The accuracy of the Aschheim-Zondek test is not impaired by this new technic.

## BOOK NOTICES

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Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,  
Bureau of Medicine and Surgery, Navy Department,  
Washington, D. C.

(For review)

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ACCIDENTAL INJURIES, by *Henry H. Kessler, A. B., M. D., F. A. C. S., F. A. P. H. A., Medical Director, New Jersey Rehabilitation Clinic, etc.* Lea and Febiger, Philadelphia, 1931. Price, \$10.

A volume on the medico-legal aspects of accidental injuries based on the author's experience with more than 63,000 cases examined at the New Jersey Compensation Bureau, supplemented by the findings of foreign experts.

Chapter I gives a brief history of workmen's compensation. Chapter II considers the medical aspects of the compensation laws. Chapter III analyzes and gives schedules of compensation existing in the different States. Chapters IV and V are devoted to the pathology and the end-results of trauma. Chapter VI takes up the general principles underlying disability.

The following 10 chapters give a thorough discussion of the subject as applied to the different parts of the body—upper extremity; lower extremity; head; spine; thorax; abdomen and abdominal cavity; hernia; genito-urinary apparatus; eye, ear, nose, face, and throat. The last three chapters deal with traumatic neuroses, occupational disease, and the rehabilitation of the physically handicapped.

The text is well illustrated and at the end of each chapter there is an extensive bibliography.

Naval medical officers, on duty at navy yards or other stations employing civilian workers, will find this book most useful.

SURGICAL PATHOLOGY OF THE GENITO-URINARY ORGANS, by *Arthur E. Hertzler, M. D., Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kansas, Professor of Surgery, University of Kansas.* J. B. Lippincott Co., Philadelphia. Price, \$5.

This volume is one of a series of monographs on surgical pathology by Doctor Hertzler. Those previously published include:

Surgical Pathology of the Diseases of Bones, and Surgical Pathology of the Skin, Fascia, Muscles, Tendons, Blood and Lymph Vessels. A number of others are in the process of preparation.

In this monograph the subject matter is divided into three parts, the first deals with the diseases of the external genitalia in the male; the second, with diseases of the prostate and bladder; and the third, with diseases of the kidney and ureter. The various individual diseases are discussed from the standpoint of pathogenesis, pathology, and histology. The text is supplemented by 222 excellent illustrations, and a discussion of the literature on the subject is given at the end of each chapter. This book is very readable and the style is delightful.

A TEXTBOOK OF EXODONTIA, ORAL SURGERY AND ANÆSTHESIA, by *Leo Winter, D. D. S., Professor of Oral Surgery and Director of the Oral and Minor Surgery Clinic, New York University College of Dentistry; Visiting Dental Surgeon in Charge, Bellevue Hospital; Lecturer in Oral Surgery, New York Homeopathic Medical School; Oral Surgery, Flower Hospital; Lieutenant Commander, DC, V(S), U. S. N. R.; Special Lecturer and Instructor in Oral Surgery, Dental Department, U. S. Naval Medical School; Visiting Dental Surgeon, New York Founding Hospital.* Second edition. C. V. Mosby Co., St. Louis, 1931. Price \$10

The first edition of this book appeared in 1927 and the fact that it has gone into its second printing greatly enlarged and revised, proves its worth. This volume contains 455 pages of clear, concise text, augmented by 426 illustrations, and it is noted that there is no attempt at compilation from the work of others, except for the chapter on General Anæsthesia by James Taylor Gwathmey, M. D., professor of clinical surgery at New York University.

In order that each form of operative technic may be followed step by step, many of the illustrations of the previous edition have been omitted and supplanted by over 100 artists' drawings from life, anatomically correct and in established sequence. Thus by visual reproduction of form and outline the student or practitioner is enabled to acquire knowledge more rapidly.

In the new edition of this work, the author has endeavored to incorporate the results of recent studies in general and local anæsthesia, post operative pain, and the use of heliotherapy in post exodontia conditions.

Doctor Winter's endeavor to bring the very latest methods of practice in exodontia before the dental profession will prove a source of benefit to his fellow practitioners.

**FRACTURES OF THE JAWS**, by *Robert H. Ivy, M. D., D. D. S., F. A. C. S., Professor of Maxillo-Facial Surgery, Graduate School of Medicine, and of Clinical Maxillo-Facial Surgery, School of Dentistry, University of Pennsylvania; etc., and Lawrence Curtis, A. B., M. D., D. D. S., Assistant Professor of Maxillo-Facial Surgery, Graduate School of Medicine and School of Dentistry, University of Pennsylvania.* Lea and Febiger, Philadelphia, 1931. Price, \$4.50

This small volume of 180 pages contains a wealth of practical information on the treatment of fractures of the jaws and their complications. Supplementing the text are 177 excellent illustrations.

In the preface the authors justly state: "One great advantage of the methods advocated is that they can be employed by surgeon, oral surgical specialist, or dentist immediately, regardless of the case, without resort to highly technical dental laboratory procedures, so that practically no time is lost in reduction and fixation of the fragments. The numerous illustrations, most of them original, should simplify the carrying out of the methods described."

The chapter on "Röntgenographic Technique" has been prepared by LeRoy M. Ennis, D. D. S., and the chapter on "Dietary Management in Fractures of the Jaws" by Clyde W. Scogin, D. D. S.

**DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL SURGERY**, by *Hamilton Bailey, F. R. C. S. (Eng.) Surgeon, Royal Northern Hospital, London.* Third edition. William Wood & Co., New York, 1931. Price, \$6.50

This volume of 277 pages contains a wealth of practical information. The author discusses the physical signs of the various surgical conditions in a remarkably clear and brief style. Supplementing the text are 318 illustrations. A very practical manual for both students and practitioners.

**GONORRHEA IN THE MALE AND FEMALE**, by *P. S. Pelouze, M. D., Associate in Urology and Assistant Genito-Urinary Surgeon of the University of Pennsylvania; Fellow of the Philadelphia College of Physicians.* Second edition. W. B. Saunders Co., Philadelphia, 1931.

The first edition of this book, under the title "Gonococcal Urethritis in the Male," was reviewed in the Bulletin of January, 1929.

The same clear and outspoken presentation of the subject, that undoubtedly accounted for the success of the first edition, has been adhered to in this revision.

Under Part I—Gonococcal Infections in the Male—the following new chapters have been added: Local medication of the urethra; gonorrheal arthritis; the treatment of other complications; and gonorrheal ophthalmia.

In response to requests to write a similar book upon the disease in the female, the author has added, as Part III, a section on

gonorrhea in the female. In taking this step a more appropriate title for the book had to be selected.

**MODERN PROCTOLOGY**, by *Marion C. Pruitt, M. D., L. R. C. P., S. (Ed.), F. R. C. S. (Ed.), F. A. C. S., Atlanta, Georgia; Associate in Surgery, Emory University School of Medicine, etc.* C. V. Mosby Co., St. Louis, 1931. Price, \$8.

This is a first edition text written primarily for the undergraduate student and the busy practitioner.

The various diseases of the anus, anal canal, and rectum, with their treatment, are presented in a concise manner.

The book consists of 404 pages and is well illustrated.

**THE PRACTICE OF MEDICINE**, by *A. A. Stevens, A. M., M. D., Professor of Applied Therapeutics in the University of Pennsylvania, Philadelphia, etc.* Third edition. W. B. Saunders Co., Philadelphia, 1931.

The second edition of this book appeared in 1926. The third edition, which has been entirely reset, reprinted, and thoroughly revised, has been brought abreast of the times, and gives the reader an excellent idea of the advances made in the science of medicine during that time.

In addition to rewriting 35 sections on various diseases, to bring the subject material in accord with the best modern teaching, many minor changes and elaborations have been made.

A number of subjects that did not appear in the second edition have been added. These include:

Psittacosis, toxoid prophylaxis of diphtheria, immunization to scarlet fever, immunization to measles, antitoxin treatment of erysipelas, acute polyneuritis, vaccinal encephalitis, chronic duodenal stasis and obstruction, massive collapse of the lung, hypoglycemia of endogenous origin, hyperparathyroidism, hypoparathyroidism, lipoid cell splenomegaly of Niemann-Pick, spontaneous subarachnoid hemorrhage, and family and hereditary atrophy of the optic nerve.

The descriptions of the various diseases, which include tropical diseases, are given in such a concise manner that the reader is readily able to grasp the principal details.

The book is intended primarily as a textbook for the student and the busy practitioner, and, as such, does not aim to supply all the information needed by the specialist in internal medicine.

**RECENT ADVANCES IN MEDICINE**, by *G. E. Beaumont, M. A., D. M. (Oxon), F. R. C. P., D. P. H. (Lond.), Physician, with charge of Out-patients, Middlesex Hospital, etc., and E. C. Dodds, M. V. O., M. D., Ph. D., B. Sc., Courtauld Professor of Biochemistry in the University of London; etc.* Sixth edition. P. Blakiston's Son & Co., Philadelphia, 1931

This is the sixth edition of this popular book, the first of which appeared in 1924. Frequent revision of a book of this type is neces-



sary to keep up with the advances made in medicine, especially in the methods used in clinical and laboratory investigation of disease, and also in treatment.

This edition has been thoroughly revised. New material has been added and deletions have been where indicated in order not to increase the size of the book.

The new material includes: An article on uremia; a detailed description of the graphic method of determining basal metabolism with the Benedict-Roth apparatus; recent work in the treatment of pernicious anemia by a stomach extract; Aschheim-Zondek test in pregnancy; additions to treatment of diabetes and relationship of acetone bodies to diabetic coma; and further discussion of the importance of lactic acid in gastric contents in suspected carcinoma.

The references given at the end of each chapter show the sources, other than the authors' wide experience, from which the information given has been obtained.

**RECENT ADVANCES IN PULMONARY TUBERCULOSIS**, by *L. S. T. Burrell, M. A., M. D. (Cantab.), F. R. C. P. (Lond.), Senior Physician to Royal Free Hospital; etc.* Second edition. P. Blakiston's Son & Co., Philadelphia, 1931

Doctor Burrell describes the advances that have been made in our knowledge of tuberculosis, since the publication of the first edition of this book.

He states that: "It is mostly along surgical lines that progress has been made, and in this edition the chapter on thoracoplasty, extrapleural pneumolysis and phrenic evulsion has been much enlarged, and new pages dealing with intercostal neurectomy, cauterization of adhesions and oleothorax have been inserted."

Other new material includes: Further experiments with the Billie-Calmette-Guerin bacillus in immunization; poisonous gas and war injuries as the causation or aggravation of tuberculosis; pregnancy and tuberculosis; and modern views concerning diets and the value of vitamins.

Throughout the text are 32 very instructive X-ray photographs.

**HYPERTENSION AND NEPHRITIS**, by *Arthur M. Fishberg, M. D., Associate Physician to Beth Israel Hospital; Adjunct Physician to Mount Sinai Hospital, New York City.* Second edition. Lea and Febiger, Philadelphia, 1931. Price, \$6.50

The first edition of this book was reviewed in the July, 1930, number of the Naval Medical Bulletin.

This edition, to meet the advances in this field, has been extensively revised. Among the sections that have been rewritten or added are: The chapter on retinal diseases, renal acidosis, azotemia with chloride deficiency, the Addis ratio, the pathogenesis of edema, the kidney in diabetes and hemoglobinemia, the role of sensitization

in glomerulonephritis, renal osteo-dystrophy, the carotid sinus and regulation of blood pressure, cardiac failure in hypertension, and paroxysmal hypertension in suprarenal tumors.

At the end of each chapter there is an extensive bibliography, making the book a valuable reference addition to the library.

**A CLINICAL STUDY OF ADDISON'S DISEASE**, by *Leonard G. Rowntree, M. D., and Albert M. Snell, M. D., Division of Medicine, The Mayo Clinic and The Mayo Foundation, Rochester, Minnesota.* W. B. Saunders Co., Philadelphia, 1931

This excellent monograph on Addison's disease is based on a study of the records of 108 cases, seen at the Mayo Clinic, which the authors regard as authentic examples of the syndrome which Addison described.

Beginning with a brief history of the knowledge of the suprarenal glands prior to 1855, an interesting description of Addison's classical work and the development of the modern conception of the pathological physiology of the suprarenal glands as it pertains to Addison's disease, the authors proceed with a practical discussion of their clinical observations, laboratory studies, and results from treatment.

Under specific organotherapy they include their experience with the Muirhead treatment, the cortical hormone of Swingle and Pfiffner and hexuronic acid isolated from the cortex of the suprarenal gland by Szent-Györgyi.

A bibliography consisting of 142 references completes the work.

**DIAGNOSIS IN JOINT DISEASE**, by *Nathaniel Allison, M. D., F. A. C. S., Professor of Surgery, in Charge of Division of Orthopedic Surgery, University of Chicago, etc., and Ralph K. Ghormley, M. D., Associate in Orthopedic Surgery, Mayo Clinic; Assistant Professor of Orthopedic Surgery, Mayo Foundation, Rochester, Minnesota, etc.* William Wood & Co., New York, 1931. Price, \$9

In an attractively bound and remarkably well illustrated volume, the authors present their observations from a study of 289 cases of joint disease.

Their experience shows the need of greater accuracy in methods of diagnosis and the necessity for a common terminology for the classification of the various disease processes.

The method of study in each case included, in so far as possible, a clinical, radiological, bacteriological, chemical, and pathological examination.

As a result of their work the authors have been able to group a large percentage of joint disease under a simple and workable classification based on etiology and pathology. In fact they rightly state:

Any classification of any group of disease processes should have for its basis the etiologic factors responsible and the primary tissue changes which result.

Various types of joint disease are discussed, giving case histories and a bibliography of the subject. The Röntgenograms, illustrations

of tissue sections, and the color plates, which illustrate the subject material, are excellent.

**A TEXTBOOK OF NEURO-ANATOMY**, by *Albert Kuntz, Ph. D., M. D., Professor of Micro-Anatomy in St. Louis University School of Medicine.* Lea and Febiger, Philadelphia, 1931. Price, \$5.50

This book aims to eliminate some of the difficulties encountered by students in studying neuroanatomy. The text has been arranged to make this complex and intricate subject relatively simple and understandable.

As the author states in the preface:

The material has been arranged with a view to giving the student an adequate conception of the human nervous system as a whole early in the course and then to acquaint him with the simpler reflex and correlation mechanisms in the spinal cord and brain stem before taking up the long conduction pathways and the higher subcortical and cortical mechanisms. The conduction pathways are studied from the point of view of their specific functions and are considered in their entirety, i. e., every central pathway is considered in its functional relationship to peripheral neurons and to any other central pathways which may be involved in the conduction of impulses to or from the highest center with which the pathway in question is functionally associated. The cerebral cortex is discussed mainly from the standpoint of its phylogenetic development and in the light of the more recent studies of cortical cytoarchitecture and functional differentiation. The autonomic nervous system is treated in a separate chapter which follows the chapter on the structure of the diencephalon and precedes the chapters on the cerebrum because the highest centers which are known to exert regulatory influences on visceral functions through the autonomic system are located in the diencephalon.

The text consists of 359 pages supplemented by 197 excellent engravings.

**PRACTICAL PHYSIOLOGICAL CHEMISTRY**, by *Philip B. Hawk, M. S., Ph. D., President of the Food Research Laboratories, Inc., New York City, and Olaf Bergel, M. S., Ph. D., Associate Professor of Physiological Chemistry in the University of Illinois, College of Medicine, Chicago.* Tenth edition. P. Blakiston's Son & Co., Philadelphia. Price, \$6.50

This is the twenty-fifth anniversary of this well known and widely used textbook on physiological chemistry. In this edition the text has been entirely reset and largely rewritten. The authors have followed in many instances the suggestions of teachers and the opinions of actual users in the classrooms in reorganizing and rewriting the book.

The chapter on physicochemical properties of solutions and the three chapters dealing with proteins have been rewritten. The chapter on endocrine organs has been completely revised. The subject of metabolism has been expanded and subdivided into three chapters as follows: Protein, carbohydrate and fat metabolism; inorganic metabolism; and vitamins and deficiency diseases. The revision has brought up to date all the phases of biochemistry within the scope of the book. There are 280 illustrations of which 41 are new.

A TEXT-BOOK OF GENERAL BACTERIOLOGY, by *Edwin O. Jordan, Ph. D., Professor of Bacteriology in the University of Chicago and in Rush Medical College.* Tenth edition. W. B. Saunders Co., Philadelphia, 1931

Any book which is in its tenth edition in a little over 20 years is certainly abreast of current knowledge and is so well known to the profession that no introduction is necessary. This is particularly true of a book that has served as a basis of instruction in bacteriology for a large percentage of medical men.

The present edition has followed the make-up and appearance of the former editions. The changes being those of revision to bring the work up to date.

Sections dealing with variation, undulant fever, the paratyphoid group, filterable virus diseases, pathogenic yeasts, anaerobes and bacteriophage have received the most change.

Most interesting to reviewer is the more or less wide use of the bacterial nomenclature approved by the Society of American Bacteriologists.

BEDSIDE INTERPRETATIONS OF LABORATORY FINDINGS, by *Michael G. Wohl, M. D., Associate Professor of Experimental Medicine, Temple University Medical School, etc.* C. V. Mosby Co., St. Louis, 1931. Price, \$6

The number of books on clinical laboratory procedures increases each year. However, as Doctor Joseph McFarland states in the introduction of this manual: "There are plenty of excellent books on laboratory technic—some of them very large books that cover the field with the utmost minutiae, telling a dozen different methods for accomplishing each desired end, but often leaving the reader uncertain which is easiest to perform and most certain in its results."

This book has been written to supply this information—to quote the author:

\* \* \* It is hoped that this volume will aid the physician in selecting the proper tests for his bedside diagnosis; in brief, this book aims to correlate the laboratory and clinic. It aims to place a proper evaluation upon laboratory reports as applied at the bedside. It aims to omit such tests as are excessively complicated or whose merits are still to be proved, and to emphasize the simpler useful ones that can be performed in his own office by an intelligent practitioner. It aims to acquaint the general practitioner with the recent advances in scientific medicine. It aims to emphasize the fact that a laboratory report is only an adjunct to diagnosis, and not the diagnosis itself.

Beginning with the sputum, practical methods for examining the body excretions and infections of various organs are discussed.

Doctors C. Mazer and J. Hoffman contributed the chapter on Laboratory Tests for Pregnancy. A list of references is given at the end of each chapter. The text consists of 321 pages with 306 illustrations.

**A MANUAL OF CLINICAL LABORATORY METHODS**, by *Clyde Lottridge Cummer*, Ph. B., M. D., F. A. C. P., *Formerly Associate Clinical Professor of Clinical Pathology, School of Medicine, Western Reserve University, Cleveland; etc.* Third edition. Lea and Febiger, Philadelphia, 1931. Price \$6.75.

The fact that this manual of clinical laboratory methods has reached its third edition attests its popularity as a textbook for students and as a laboratory guide for physicians and technicians.

In this edition the following new material has been added: Kline's microscopic slide precipitation tests for syphilis; silver impregnation methods for treponema; Alzheimer method for studying the cellular contents of the spinal fluid; newer methods of demonstrating oxydase granules; and Newcomer's method for determining the hemoglobin content of the blood.

The author has also added descriptions of cistern puncture, the icterus index, the alcohol test-meal, the sedimentation of red blood cells, the use of histamin in studying the secretion of hydrochloric acid by the stomach, diagnosis of granuloma inguinale, the Queckenstedt test on the spinal fluid, agranulocytic angina, acute infectious mononucleosis, Schilling's simplified method for the Arneth count, leukocyte fragility, and agglutination test for tularemia and undulant fever.

Dr. R. D. Leas revised the chapters dealing with blood counting and the histology and pathology of the blood and the anemias.

Dr. M. A. Blankenhorn contributed the chapter on basal metabolism.

**RECENT ADVANCES IN MICROSCOPY**, Edited by *A. Piney, M. D., M. R. C. P., Director of the Pathological Department, Cancer Hospital, London.* P. Blakiston's Son & Co., Philadelphia, 1931

A new addition to the Recent Advances Series, the series at present consisting of 24 books on as many different branches of medicine.

This volume of 260 pages consists of four sections, all contributed by recognized authors: The Medical Sciences, by A. Piney; the Living Eye, by Basil Graves; Zoology, by E. W. MacBride and H. R. Hewer, and Botany, by E. C. Barton-Wright.

According to Dr. Piney "recent advances in this subject consist mainly in improvements in technic and in new observations of fine structure."

Doctors MacBride and Hewer state:

The rise of the hormone theory and the importance of enzymes in relation to both sexual and general physiological phenomena has stimulated investigations into the structure and function of the various components of the cell other than the nucleus. Thus most of the recent work centres around the activities of the Golgi apparatus, mitochondria, the phenomena of secretion, absorption of food and other activities of the normal cell. \* \* \*

In connection with the cytology of cancer these same authors quote the interesting conclusions of Ludford:

"It has been pointed out that with our present microscopic technique there is no means of distinguishing between a normal and a cancerous cell. The wide range of pathological variations are the morphological expression of the reaction of the cells to the peculiar conditions of tumor growth. There is no pathological state restricted to cancer cells alone, so that there exists for the cancer cell no precise morphological diagnostic character of any kind.

"\* \* \* New methods of research will have to be devised, therefore, before we can explore cytologically the possibilities opened up by the work of these investigators (Gye and Barnard)."

**CUTANEOUS X-RAY AND RADIUM THERAPY**, by *Henry H. Hazen, A. M., M. D.*, *Professor of Dermatology, Medical Department of Georgetown University, etc.* C. V. Mosby Co., St. Louis, 1931. Price, \$3

A very practical manual on the use of X ray and radium in the treatment of diseases of the skin. The apparatus, standardization and dosage estimation, and the technic involved in the use of radium and X ray are described.

Diseases suitable for radiation and the action of irradiation upon tissue are discussed.

The clinical application of X ray and radium therapy is taken up under the various diseases of the skin and appendages.

In addition to the selection of cases and advice as to technic Doctor Hazen calls attention to the many pitfalls and the danger of an excessive number of small doses.

Those using this form of therapy will find that this small volume of 166 pages contains a wealth of practical information.

**THE SURGICAL CLINICS OF NORTH AMERICA**. JUNE, 1931. Volume II, Number 3. W. B. Saunders Co., Philadelphia, 1931.

The New York number of the Surgical Clinics of North America for June, 1931, might appropriately be called "the fracture number."

Fully one-half of the articles are from the clinics of the New York Fracture Committee of the American College of Surgeons.

In addition to a contribution by Dr. Charles L. Scudder—Opportunities for Contact with Recent Fracture Treatment—these articles include:

Clinic of Dr. William Darrach on open treatment of fractures.

Clinic of Dr. Royal Whitman on the abduction treatment of fracture of the neck of the femur.

Clinic of Dr. Armitage Whitman on the plaster-of-Paris spica as an adjunct of the abduction treatment.

Clinic of Dr. Seth M. Milliken on methods of treatment in various forms of fractures.

Clinic of Dr. Fenwick Beekman on care of compound fractures.

Clinic of Dr. Leo M. Davidoff on fractured skulls.

Clinic of Dr. Walker E. Swift on the pathology of fractures of the spine.

Clinic of Dr. Win H. Watters on treatment of fractures of the spine.

Clinic of Dr. Robert H. Kennedy on emergency treatment of fractures.

Clinic of Dr. S. P. Bartley on traumatic separation of the symphysis pubis and right and left sacro-iliac joints, complicated by internal injury (retroperitoneal hemorrhage) and treatment of fractures of the body of the os calcis; demonstration of technic (open and closed); demonstration of end results.

Clinic of Dr. James Harry Heyl on fracture of the patella.

Clinic of Drs. Sigmund Mage and Thomas McGrain Lowry on fractures of the shaft of the femur.

The rest of the number is devoted to miscellaneous surgical subjects.

**THE SURGICAL CLINICS OF NORTH AMERICA, AUGUST, 1931. W. B. Saunders Co., Philadelphia, 1931**

The Mayo Clinic number of the Surgical Clinics of North America for August, 1931, is devoted to a number of interesting miscellaneous surgical subjects.

Clinics of Drs. E. Starr Judd, C. Oliver Heimdal, and Richard S. Anderson deal with pharyngo-esophageal diverticula in women, stricture of common bile duct associated with pregnancy, and hematuria with multiple metastatic abscesses of the kidney.

Clinics of Drs. D. C. Balfour and H. I. Down discuss cases of bleeding ulcer on posterior wall of duodenum, perforating ulcer on posterior wall of stomach, recurring gastrojejunal ulcer following repair of gastrojejuno-colic fistula.

Clinics of Drs. W. Walters, J. B. Priestly, and H. K. Gray include: Total gastrectomy; Billroth I procedure for extensive malignant growths; pylorotomy for hemorrhagic ulcers; hepaticoduodenostomy for strictures of the common bile duct; resection of the common bile duct; and plastic operations on the penis in cases of exstrophy of the bladder.

Dr. J. S. Lundy gives his experience with sodium ethyl barbiturate in connection with anesthesia in more than 2,300 cases.

**THE MEDICAL CLINICS OF NORTH AMERICA, JULY, 1931. W. B. Saunders Co., Philadelphia, 1931**

This number, known as the Mayo Clinic number, contains 28 articles by members of the staff of the Mayo Clinic and the Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota.

The first paper is by Walter C. Alvarez and Charles H. Mayo on "Pseudo-appendicitis cured by short-circuiting a malfunctioning ileocecal sphincter." A case is given in which this operation was performed with beneficial results. They emphasize, however, that this operation is indicated only in those cases where repeated röntgenological examinations show definite ileal stasis.

L. G. Rowntree and A. R. Kintner have written an instructive paper on "Some problems in clinical diagnosis." A number of cases are cited in which a diagnosis was made only after careful and prolonged study.

Willis S. Lemon discusses a group of rare intrathoracic tumors seen at the clinic over a period of years.

F. A. Willius and A. R. Barnes present data on eight patients whose recovery following cardiac infarction was unusually satisfactory.

B. R. Kirklin has an article on "Duodenal ulcers that may escape röntgenologic diagnosis." By technical strategy and study he is of the opinion that not less than 95 per cent of duodenal ulcers can be revealed by X ray.

**THE MEDICAL CLINICS OF NORTH AMERICA, SEPTEMBER, 1931.** W. B. Saunders Co., Philadelphia, 1931

This is a Philadelphia number of the Medical Clinics. As usual, there is a wide variety of topics, including leukemia, trichiniosis, lung abscess, diabetes, lobar pneumonia, bronchomycosis, nephritis, arthritis, tuberculosis, neurosyphilis, and endocarditis.

The Medical Clinics are well worth reading and this number is no exception.

**NINETEENTH ANNUAL REPORT, MEDICAL DEPARTMENT, UNITED FRUIT COMPANY, 1930**

The comments and articles on malaria are especially interesting. Considerable experimental work is being done to determine the optimum dosage of plasmochin and quinine required to give the most satisfactory results in the control of this disease. It is believed that maximum results are obtained when these two drugs are used together—plasmochin to devitalize or sterilize the gametocytes and quinine to take care of the asexual forms.

H. C. Clark and L. H. Dunn in their experiments to transfer monkey malaria to man found "that red spider monkey malaria and the human benign species of malaria that it so closely resembles are not identical and that the monkey is not, therefore, a reservoir for human malaria."

A number of articles are devoted to a discussion of amoebiasis, among them "the Diagnosis of *Endamoeba histolytica*" by E. C.



Faust and "the Treatment of Amoebiasis with Anayodin" by F. W. O'Connor and C. R. Hulse.

Other articles dealing with tropical diseases, general medicine and general surgery, and the statistical data appended make this a valuable publication for those interested in tropical diseases and in the prevalence of cosmopolitan diseases in the Tropics.

GOULD'S MEDICAL DICTIONARY, by *George M. Gould, A. M., M. D., Author of "An Illustrated Dictionary of Medicine, Biology, and Allied Sciences,"* etc. Third Edition. P. Blakiston's Son & Co. (Inc.), Philadelphia, 1931. Price, \$7.50

The third edition of Gould's Medical Dictionary contains many new words from recent medical literature. The latest International Table of the Causes of Death (courtesy of the Bureau of Census, Department of Commerce, 1931) has been included.

Dr. D. H. Bergey, professor of hygiene and bacteriology, University of Pennsylvania prepared the three new tables on bacteria, metazoa, and protozoa.

The Gould system of simplifying medical orthography has been adhered to. In addition to the conventional flexible binding, this edition is supplied with a rigid style of binding to meet the requirements of those who desire a book which will stand up on the shelf more satisfactorily.



# THE DIVISION OF PREVENTIVE MEDICINE

Capt. W. H. BELL, Medical Corps, United States Navy, in charge

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## NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

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### THE ROENTGENOGRAM IN EARLY TUBERCULOSIS IN ADULTS<sup>1</sup>

By F. MAURICE MCPHEDRAN, M. D.

In this paper there will be discussed the interpretation of roentgenograms taken in the cases of those having or suspected of having pulmonary tuberculosis. It has been shown (1, 2, 3, 4) that by means of the X ray tuberculosis may be discovered and its course observed for months or years before the earliest appearance of symptoms or physical signs just as response to treatment may be followed long after these traditional evidences have subsided. The first consideration is what constitutes an adequate roentgenographic record.

*Case finding.*—As a sieve for the separation from a presumably healthy group of suspected cases for complete roentgenographic examination fluoroscopy (5) has decided advantages over the physical examination of the chest. It has also, of course, special diagnostic value in determining the mobility of the diaphragm and the range of expansion of both lungs. Many make a fluoroscopic survey of the lung fields followed by X-ray films so exposed as to bring out the areas suspicious in the fluoroscopic screen. No doubt their aim can often be realized, but to exclude the presence of a significant lesion the roentgenograms must also in all cases be accurate with regard to the apices and the areas close to the heart. If these are shown well, and especially if an oblique view is made in addition, the most difficult fields will be recorded and the chances of overlooking a material lesion are remote. If for reasons of economy in case finding among large numbers of apparently healthy persons a single flat film is made without fluoroscopic guidance, it must be of the indicated quality to be reasonably informative. The tuberculin reaction as a basis of selection among school children, and the fundamental significance of a history of contact with sputum-positive tuberculosis, have been discussed elsewhere (6, 1).

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<sup>1</sup> From the Henry Phipps Institute of the University of Pennsylvania.  
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*The production of an adequate X-ray record.*—Whatever the method of case finding, stereoscopic films are essential to accurate diagnosis. It is possible for a serious infiltration to be concealed by the clavicle and ribs in one film (see fig. 27 of reference 4). It may even be imperceptible in either film of a stereoscopic pair, yet be clearly discernible in the pair viewed stereoscopically. This is, of course, chiefly the case when the lesion lies above or close below the level at which the shadow of the clavicle falls, that is, usually, in the third or fourth postero-lateral interspace or above in the second posterior interspace. Moreover, how far one or more of these interspaces is covered will depend on the position of the patient and the level of the tube, that is, the angle of incidence of the beam of the X rays.

The position of the patient is a matter of no little importance. The object is to secure as good exposure as possible of the whole lung field, but particularly the apex. The patient should face the film, largely because of the greater width of the anterior interspaces, and should stand with the chest as close to the film as possible, the chin elevated and resting above it. The shoulders should be shoved forward to touch the surface of the cassette-changer, the arms rolled out and slightly flexed, so that the outer side of the elbows is in contact with the cassette-changer. In this way the scapulae are well removed from postero-lateral third and fourth interspaces. This is essential, since from these areas the rapidly progressive tuberculous infiltrations of early adult life spread mesially into the lung (figs. 1, 2, 3, and 4). (See also figs. 27, 28, 29, 30, 31, 32 of reference 4.) The shoulders should be held low, the hands reaching down as if to grasp something, if the extreme apex is to be well seen. The shadow of the clavicle should then, if the patient presses the shoulders and chin firmly forward, cross the posterior fourth rib in the film. The beam of the X rays will pass at a tangent to the posterior apical curve, the original site of many lesions (fig. 5). Little of the extreme apex will be hid when the shadow of the posterior second rib overlaps the lower margin of the first leaving a cleared second interspace, into which infiltration projects as strands, salients or spots. The tube should be leveled so that the third dorsal spine is at the mid-point of the stereoscopic shift, otherwise the apex will not be shown free of rib shadows. The flat chest, with ribs sloping rapidly down, does not allow a very good view of the apex, and for anything approaching a tangential view the tube should be leveled lower than usual. Conversely when the spine is bowed the tube center should be higher. Horizontal ribs in an erect type allow better exposure than sloping ribs in a bent type of figure.

For no areas are the difficulties in recording fully the differences in density of pulmonary structure (the function of the roentgenogram)

greater than for the apex. As the cone of the lung as a whole narrows from base to apex the mass of muscle increases, so that one is seeking differentiation and contrast within a small air-bearing volume of parenchyma overlaid by an increasing volume of dense tissue. Clearly to make one roentgenogram equally satisfactory for all areas of the chest of a muscular man is impossible. If the apical structure is well differentiated that in the lower third below the shadow of the pectoral muscle is wiped out.

These difficulties are commonplaces of chest roentgenography. To meet them we have found it desirable to make special apical exposures in cases where a full range of differentiation is essential. This is done with economy of material and of technician's time by making an apical exposure on one end of a pair of 17 by 14 films, the lower half of each film being covered by lead; the cassettes are then reversed and another apical exposure is made on the other end of the film. A difference in density between the two apical exposures may of course be obtained by an increase of milliamperage or an increase of kilovoltage. For some six or seven years we have found that, with an accurate storage-battery filament control capable of changing filament amperage by 0.005 of an ampere, we can obtain the most useful variations in density by using the same applied primary voltage for both exposures and changing the filament current by 0.01 ampere. Filament control of such precision has been lacking in commercial apparatus. Some approach to it is being introduced in new models, it is said. We feel that the range of adjustment we use is not too fine.

Variations in the definition and clarity with which are recorded the normal anatomical structures of the lung have contributed much confusion to the diagnosis of early tuberculosis in the adult. Probably no factors have been more discussed than tube-film distance and speed of exposure. It is clearly desirable that the tube should be so far away from the film that the shadows of lesions or structures relatively far from the film and close to the tube should not be so distorted as to be deceptive, or so diffused as to be imperceptible in the resulting image. It is likewise important that the exposure should be short enough to offset the major effects of cardiovascular movement. Unless exposures are synchronized (7) so as to fall in diastole, blurring will appear due to cardiac movement in exposures of one-twentieth second when these chance to occur during systole. To secure a short enough exposure, accurately timed and reproducible day in and day out, and at proper target-film distance with a focal spot of satisfactory quality, remains to-day as it was years ago the greatest need of chest roentgenography. Films made at 4 feet in a tenth of a second are a common compromise with the limitations of existing apparatus. If one is to observe accurately

the changes in a lesion that extends on to the posterior chest wall, such exposures represent a minimum requirement unless both postero-anterior and antero-posterior films are to be made. The focal spot, of course, should be the smallest from which can be produced the required density of films and differentiation of structure.<sup>2</sup>

Stereoscopic films need to be supplemented by a routine oblique exposure in cases sufficiently suspicious to be recommended for X-ray examination. The left anterior oblique (8) or a position slightly less rotated has advantages over the lateral when the presence and extent of slight infiltration is to be recorded. The writer aims to have the right shoulder rotated away from the film so that the mid-frontal plane forms an angle of about 30° with the plane of the film. In this position, with the left arm hanging behind the back and the right arm bent over the head, the left cardiac border coincides with the spine in the film and the left retro-cardiac lung field, the anterior lappet of the right lung, and the tracheobronchial bifurcation are exposed. Furthermore, the postero-lateral left upper lung is viewed so that any lesion in this area is seen admirably in profile and some added information, though not so accurate, is gained if there is a lesion in the right apex. But when there is a lesion on the right the opposite rotated exposure is made.

It is always informing to view a lesion in two dimensions, one of which should be a profile of its maximum extent. The exact boundaries of the site of the lesion and the relative density of one part of the lesion to another part, that is, its structure, should be completely explored in every instance. All such information is essential to diagnosis, prognosis, and treatment. No more costly oversight occurs in the treatment of tuberculosis than the failure to perceive in the quality of shadow the evidence of its capacity for change. Support of this will be found in the only valid control, closely spaced serial films of the homogeneous and softly cloudy infiltrations of early adult life. (See figs. 27, 28, 29 of reference 4.) No doubter, no defeatist could long remain unstirred by the possibilities so presented of treatment intelligently adapted to the retrogression, the progression, or the menacing sluggishness of these consolidations.

#### INTERPRETATION OF X-RAY FILMS

*Apical lesions.*—The one characteristic common to all but the rarest early localized tuberculous infiltrations is that they are based on, or have their maximum density on, the pleura. From this base, by suitable rotation of the patient so that the site is viewed tangentially, it

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<sup>2</sup> In selecting an X-ray tube the pinhole camera should be used to determine the size of the focal spot and the symmetrical distribution of energy upon it. The sharpness of the image and the life of the tube depend upon such measurements, which should be repeated at intervals during the use of the tube.

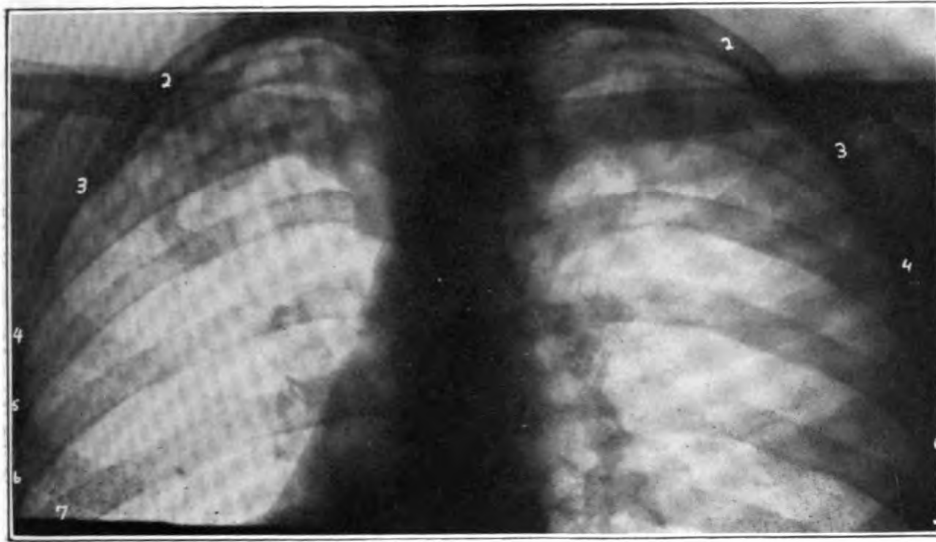
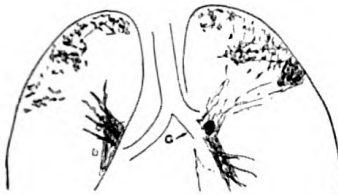


FIGURE 1.—VI. SCH., BOY, AGED 14 9/12, DECEMBER, 1926



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Right: Mottling, dense above the clavicle, becoming confluent in the 4 post. i.s. Calcified lymph node in 6 post. i.s. (G in diagram). Left: Dense mottling as low as post. 4 i.s., with small rarefactions suggesting excavation in post. 3 and 4 i.s. This lesion first appeared in November, 1923, as discrete spots above the clavicle, right and left. It increased steadily with no reflection in symptoms or temperature and with few, inconstant râles as the only physical signs, until February, 1928, when cough developed with positive sputum. (See figs. 30, 31, and 32 of reference 4.) When the film reproduced above was made the boy had been in a sanatorium, but ambulant, for five months. The lesion had increased during this period.

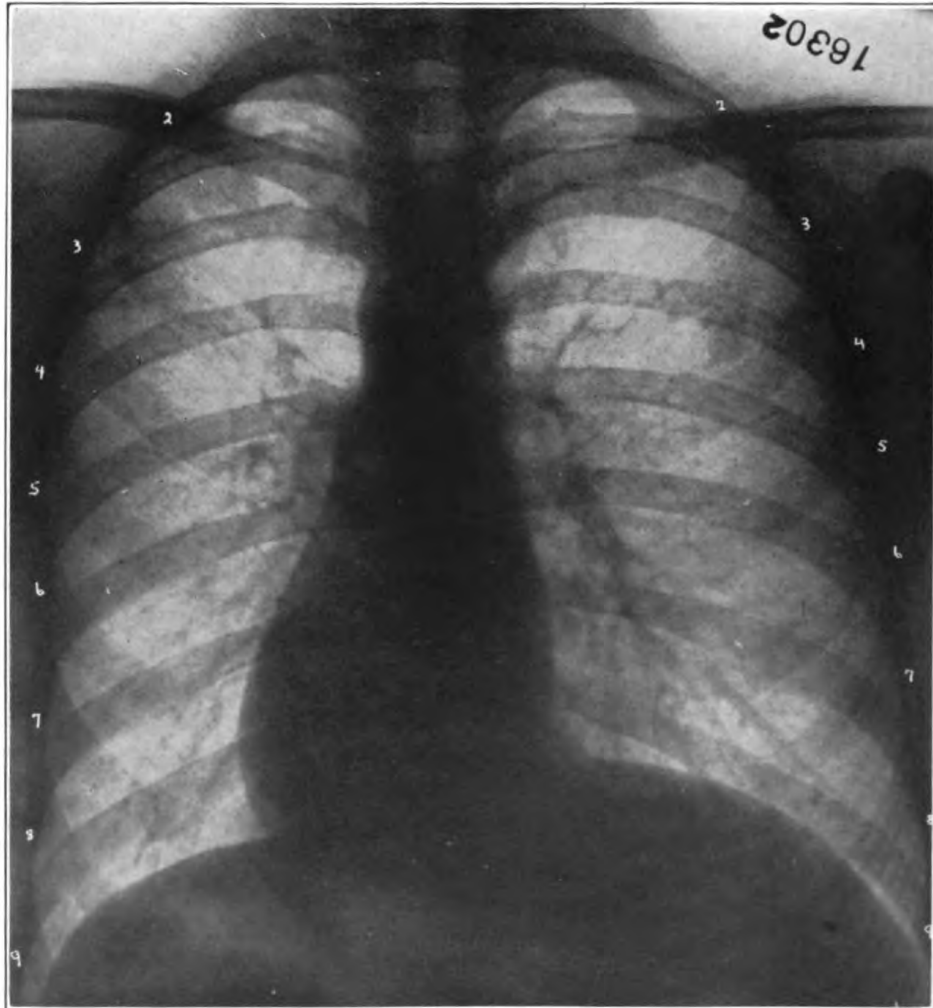


FIGURE 2.—RO. DEL., BOY, AGED 18, JUNE, 1928

Right: Irregular density in axillary post. 3, 4, and 5 i.s., with a pleural thickening beneath curve of 2 post. rib. Left: Somewhat confluent spots in axillary 2, 3, and 4 i.s., with a pleural thickening running into apex as on the right. Both lung fields otherwise normal. No signs or symptoms. Boy feels well. Weight normal. This lesion was first observed in December, 1926. In the succeeding 18 months there have been no symptoms, no deficiency in gain in weight, and no physical signs despite an increasing bilateral infiltration. See Figure 3.

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can usually be shown that the lesion extends into the lung centripetally, that is, toward the hilum, following out the structure of the lung, an integration of many cones.

Broadly speaking, one may say that in cases that develop symptoms within months after the first appearance of a lesion, the infiltrative wedge or cone rapidly extends its apex towards, not into, the hilum (figs. 27 to 29 of reference 4), and in other cases where symptoms arise only after years of invasion the development of the lesion is along a broad base on the pleura without marked extension into the inner lung zone. (See fig. 1.)<sup>3</sup>

This relation of localized tuberculous infiltration to the pleura can be verified by post-mortem material on the one hand and on the other by serial examination of young adults exposed to open tuberculosis. In excised lungs it is easy to demonstrate the subpleural site of localized tuberculous lesions, both primary nodules or more diffuse infiltrations of childhood type, and adult-type lesions, whether early or late. Particularly in serial examination of adolescent children living in household contact with open tuberculosis one may record the subpleural origin of an apical lesion in a lung formerly free and trace its spread sometimes for a matter of months, often for years, before the invasion penetrates centripetally, and symptoms arise. The earliest infiltration may appear as mottling or as salients in the extreme apex (see fig. 5), the latter with the points of the salients directed downwards like inverted mountain ranges below the second posterior rib. (Figs. 30 and 24 of reference 4.)

In other cases there will first appear a consolidation of the apex above the clavicle. (Fig. 33 of reference 4.) Rarely the initial consolidation will be wholly mesial, involving only the mesial half of the supraclavicular apex. One such case in an adolescent girl progressed in about six months to far-advanced tuberculosis. Her chest had been clear about two years before the apical consolidation developed. In other cases there will be supraclavicular salients or spots or soft strands that increase and to which is added a dense, homogeneous infiltration or confluent mottling in the third or fourth postero-axillary interspaces. In by far the majority of instances the development and spread of apical infiltrations is along the axillary pleural surface, and more often posterior than anterior to the mid-axillary line. In some cases (9), by no means so predominant as the German and part of the American literature would indicate, (10, 11, 12, 13) the earliest perceptible infiltration is recorded in the third and fourth postero-axillary interspaces. Lesions in this

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<sup>3</sup> In this paper the inner zone is that volume of lung surrounding the hilum not only laterally but also anteriorly and posteriorly. For practical purposes one might define it as bounded in all directions by radii extending half the distance from the point where the pulmonary artery becomes visible as the center to the parietal pleura as circumference.

site, if homogeneous, or made up of confluent mottling with periphery that is ill-delimited even with adequate target-film distance, often spread rapidly. Nevertheless, they appear and spread in most cases for some weeks or months before symptoms or physical signs are perceived. When symptoms do arise, they are often those of gripe or of a more trivial respiratory infection.

In summary one may say that apical infiltrations may first become demonstrable as mottling whether discrete or ill-delimited and more or less confluent, as strands or salients, sometimes sharply demarcated from the surrounding lung, sometimes distinctly fuzzy, as homogeneous consolidation that may be only about one centimeter in area (fig. 27 of reference 4) or may involve a whole apex or occupy the third and fourth axillary interspaces. The less sharply infiltrative densities of whatever form are demarcated from the uninvolved lung, the more their borders fade imperceptibly into it, the greater their capacity for change, for advance or retrogression. Only serial, closely spaced, comparable X-ray records can determine the contemporaneous direction of change, though the age of the patient in whom a lesion appears is also significant. Sharply delimited, wholly supraclavicular strands in a man in middle life are little cause for concern. In a young man they are evidence of a severe infection that may spread with little or no warning, and as a result of apparently trivial stress.

*Artefacts.*—Perhaps the most misleading normal shadow is that which may be thrown on to the posterior third and fourth interspaces when the scapula is not fully displaced by holding shoulders and elbows against the cassette changer, and even if the shadow of the margin of the scapula lies upon the axillary curve of the ribs, the muscles arising from it may cause a disturbing cloud. This may merge with the cloud due to the anterior soft tissues sweeping down from the clavicle to the anterior chest wall. Such a combination may at times require careful scrutiny to resolve it.

Above the clavicle, the shadow of the sternomastoid passing down on to the fold of subcutaneous tissue above the clavicle rarely causes difficulty, unless there is rotation of the patient's position, as shown by the relation of the mesial ends of the clavicles to the spine, or scoliosis sufficiently marked to show the apices unequally. Even in such cases it causes merely a haziness, not a demarcated intrapulmonary density such as is due to infiltration however fresh. A like haziness of one (more often the left) or both apices may appear when the subclavian arch across the apex causes an indentation into the parenchyma. In general, diffuse ill-delimited haziness should be regarded with great skepticism. When due to recent pleurisy, the clue is usually given by a dense line laterally where the thickening is tangential to the X rays. When due to old pleurisy, it is

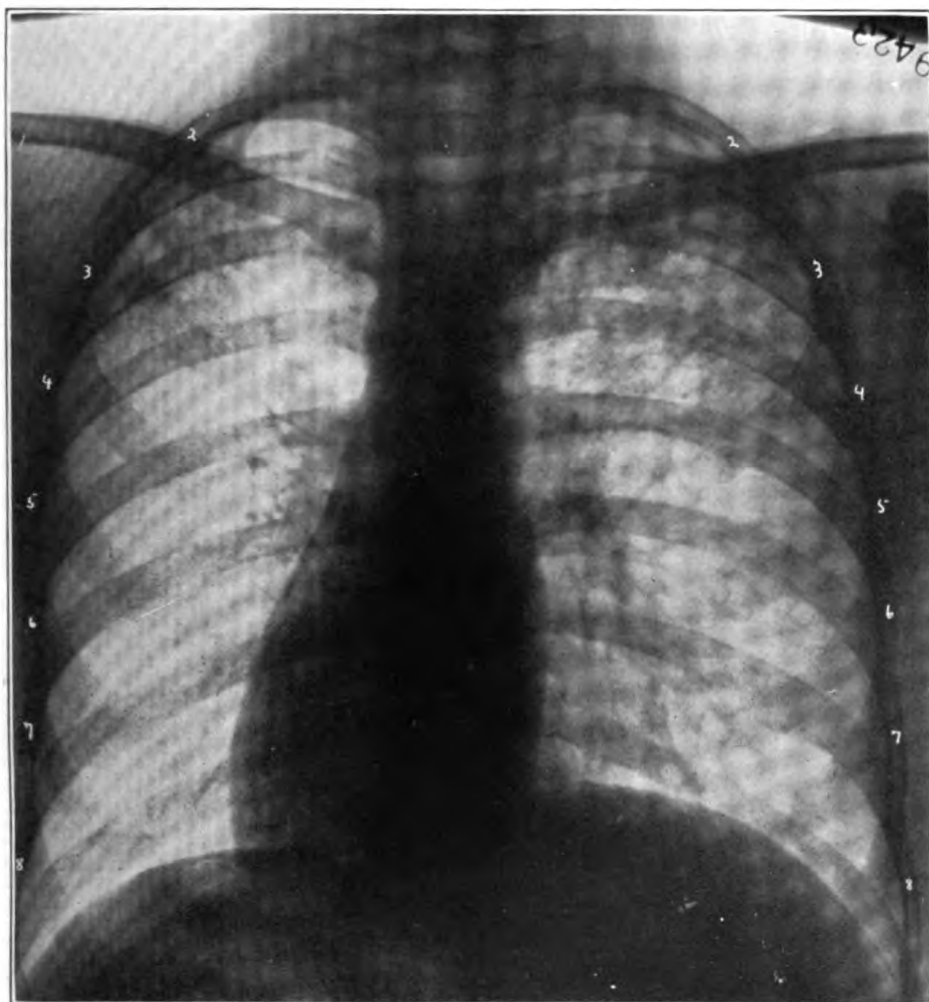


FIGURE 3.—RO. DEL., BOY, AGED 19, MARCH, 1929

Right: Dense mottling to the 6 post. rib, confluent and with excavation at the 3 post. i.s. Left: Confluent mottling in 2, 3, and 4 post. i.s. Physical signs, râles, impairment, etc., marked on the right, absent on the left. Temperature to 99.3. Has lost 6 pounds recently. Patient began to feel badly in October, with pain below right scapula. Cough began shortly after, with occasional streaked sputum, which was positive only twice in nine examinations. Patient was in sanatorium, but ambulant, from April to December, 1929. He was discharged with the lesion still ill-delimited and dangerous. See Figure 2.

96-1

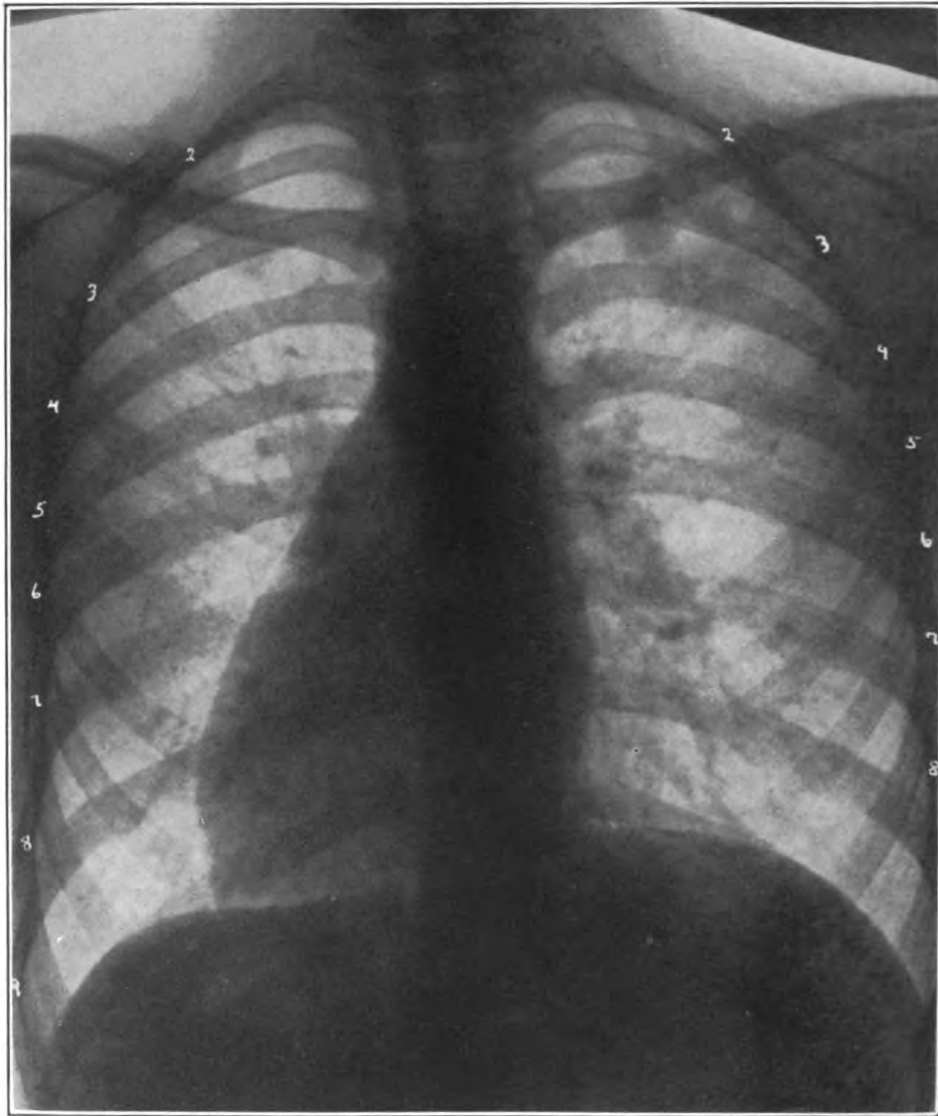


FIGURE 4.—TH. DI., GIRL, AGED 13, AUGUST, 1928



Right: At post. 2, 3, and 4 i.s. there is an ill-delimited homogeneous density about 4 cm. across with an irregular central rarefaction; calcified lymph nodes in hilum on the neck of 7 rib and below 8 rib with a calcified nodule shown on lower margin of 8 rib. Both lung fields otherwise normal. Note prominence of left ascending vascular markings, while the lesion is on the right. This unilateral prominence is an anatomical peculiarity, not due to lesion. (See also fig. 27 of reference 4, which reproduces an earlier film of this patient showing the same left-sided vascular prominence.) Râles and impairment over the left upper third. Temperature 99. Weight 80 per cent. Slight cough for some 10 days only, although excavation was first observed in May. This lesion progressed rapidly until September, 1928, but prolonged bed rest caused marked retrogression. In the diagram, A refers to the nodule, G to the calcified lymph nodes, H to the apical infiltration.

96—2

usually clear that limitation of expansion and diminished aeration are causing the haziness. When due to edema the haziness is usually basal and the factors leading to its production are evident.

An apical salient may be simulated by the scalenus medius and posterior. These cause a line concentric with the inner border of the first rib. Its sharpness and curved course suggest its origin.

Lastly, strands in the apex must be traced both cephalad and caudad. If they arise from the apical pleura and decrease toward the midst of the supraclavicular lung, they are due to infiltration. If the strand appears in the midst of the supraclavicular apex and increases toward the hilum it is due to a vessel.

This brings us to consideration of the sharpness and clarity with which the apical trunk markings may be recorded since many, even to-day, attach a pathological significance to mere prominence of the apical vascular arborization arising from the hilum. A discussion of the hilum is desirable.

The hilum shadow is made up chiefly of the pulmonary artery and its branches and the venous branches that cross the artery. The bronchus appears as a clear space mesial to the arterial main trunk supplying the lower lobe, but the right upper lobe bronchus can be seen above the right arterial shadow and often the left upper lobe bronchus can be seen crossing the artery. Chiefly because of the arterial and venous branches crossing the main arterial trunk at various angles, the hilum shadow is a very complex mixture of varying intensities of shadow. Many arterial branches may be traced back into the arterial stem and not a few venous branches, in adequate films, can be seen to cross the arterial stem and its branches and enter the heart. But unless the lymph nodes, which for the most part lie lateral to the bronchus upon the arterial stem, are so much enlarged that they project into the parenchyma (4) they can not be distinguished from the vascular mesh work in which they lie, for they are of much the same roentgenologic density. Only calcium infiltration will render the site of a node visible and even in such a case the inclosing node substance can not be recorded unless it projects into and so contrasts with the parenchyma. (See figs. 1, 10, 11, and 20 of reference 4.) Even in films of infants and young children who, as shown by the serial tuberculin reaction, have been recently infected, the affected hilum nodes are usually not recordable, although implication of the associated hilum nodes is characteristic of first infection (14).

In tuberculosis of the adult, gross involvement of the hilum nodes is characteristically absent and changes in the hilum due to enlargement of the nodes are rare. Calcification may of course be present, referable to a preceding childhood type infection (4, 1). In the great majority of cases apparent broadening and so-called

thickening of the hilum shadow is due not to disease but to cardiovascular movement during exposure (4, 7). Dependable conclusions as to the presence of any but very large lymph nodes can not be drawn when the hilum shadow is blurred. In exposures synchronized with diastole such artefacts as blurring and broadening of the hilum are lacking and, with moderate heart rates, an unsynchronized exposure of one-tenth second has about an even chance of falling in diastole.

Even in the acute broncho-pneumonias of childhood roentgenographically demonstrable enlargement of the associated nodes is lacking in all but very rare cases. We have not seen it in the acute infections of the adult. Likewise in our series of films of excised lungs recordable nodes due to acute nontuberculous pulmonary lesions were lacking (15). The hypothesis that the increased visibility of the hilum as age advances is due to fibrous tissue diffusely laid down within the hilum between vessels and bronchi lacks a basis in pathology. The connective tissue of the hilum is a delicate areolar tissue roentgenographically imperceptible at all ages. As pointed out elsewhere (4) extension of tuberculous invasion and caseation beyond the node capsule into the areolar tissue of the hilum is a rare and probably always a fatal event. The hilum shadow is more prominent as age advances chiefly because the vessels that compose it are of increasing caliber and because, as compared with the hilum of infancy and early childhood, the adult hilum stands out unobscured by the cardiac border, on the right at least. The size of the pulmonary vessels is normally subject to great variation from person to person of the same age and sex, and hence the size of the normal hilum shadow varies considerably. Pathological enlargement of the hilum shadow is due to nodes projecting beyond it or to enlargement of the vessels that normally produce it. (See fig. 40 of reference 4.)

Some years ago it was common and even to-day it is not unknown for prominence of the trunks ascending into the apex to be ascribed to tuberculosis. The description is thickening and beading of the apical trunks and the diagnosis is peribronchial tuberculosis or tuberculosis spreading out from the hilum. For such a diagnosis there is no pathological basis. There is no evidence to support the hypothesis that tuberculosis spreads out from the hilum to the periphery, presumably in the peribronchial and perivascular lymphatics. Pathological examinations fail to reveal such a process and Miller (16) has pointed out that the valves of the lymphatics, except those immediately below the pleura, all point toward the hilum. Furthermore, eight years of serial examinations of children and young adults living in household contact with sputum-positive tuberculosis has discovered the origin and development of lesions in many of them

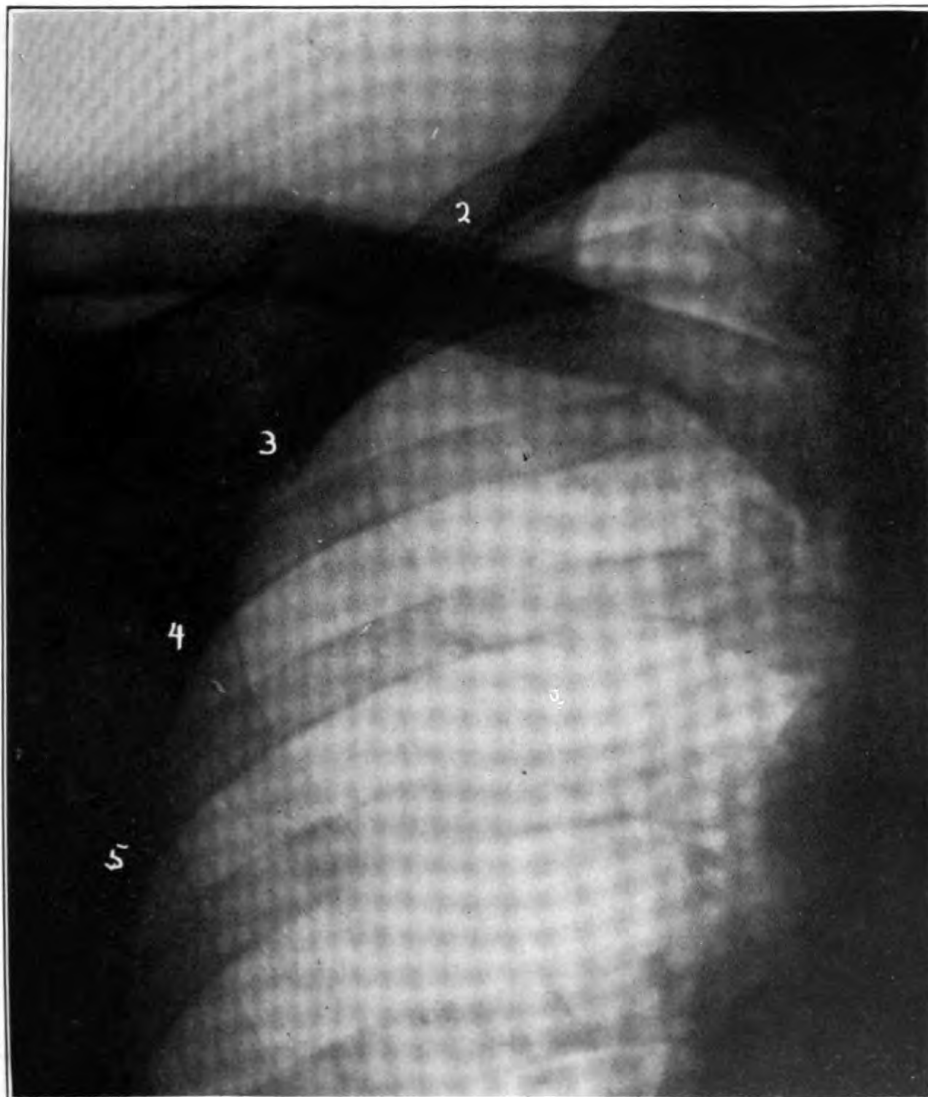


FIGURE 5.—HA. SO., MALE, AGED 23 YEARS, MAY, 1930

Below the curve of 2 post. rib, is a somewhat rounded projection reaching almost to the upper margin of 3 rib. Film otherwise normal. The irregular density in post. 4 i.s. touching the neck of 5 rib, is due to calcium within the first costal cartilage. No symptoms, signs, or deficiency of weight. See Figure 6.



98-1

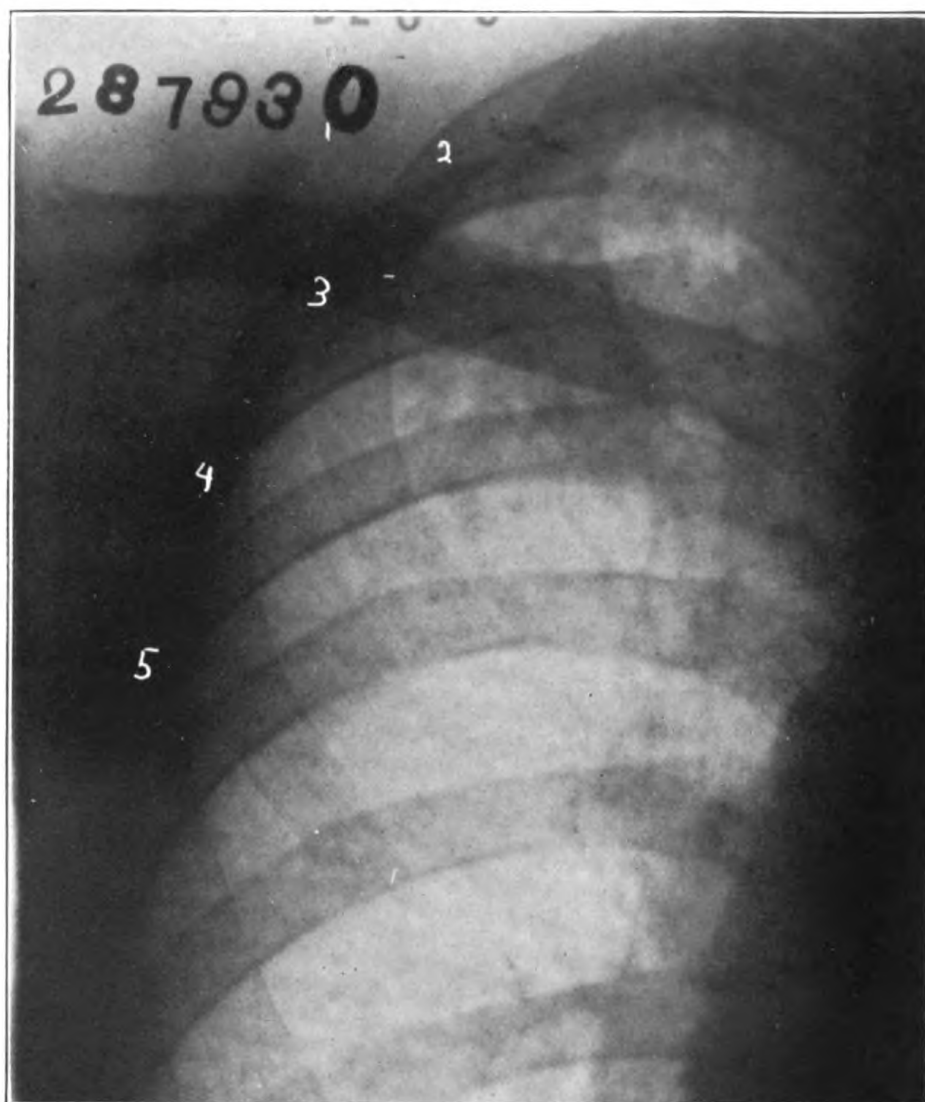


FIGURE 6.—HA. SO., MALE, AGED 24, DECEMBER, 1930

This figure reproduces a film made seven months after that of Figure 5. Note the dense mottling extending into 2, 3, 4 and 5 post. i.s. No symptoms, signs, elevation of temperature or loss of weight. A modified life was adopted at this time and lesion is now (July, 1931) retrogressive, becoming strandlike.

98—2



but in none has the relative or absolute prominence of the vessels on one side or both been of the slightest diagnostic importance. (Fig. 4.) (See also figs. 27 and 28 of reference 4, in which the prominent vessels in the reproduction as in the film, are on the (left) opposite side to the lesion.) Tuberculosis has its initial site below the pleura and from this site it spreads into the lung. As the spots of infiltration reach deeper into the lung they enter the area where the vessels are large enough to be recorded. The projection onto the one plane of the film of the shadows of vessels and of spots of infiltration situated, perhaps, wholly posterior or anterior to them, causes an appearance that has sometimes been described as beading. Selective peribronchial and perivascular deposition of tubercles such as may be suggested by the appearance in the film does not occur. To verify that the appearance is artefact, it is only necessary to make a rotation exposure of a patient in whom a softly mottled infiltration involves only an anterior or posterior section of lung. In this way, by throwing the lesion into profile, it can often be seen that the vessels that formerly appeared beaded were merely recorded on the same part of the film with the spots of infiltration. In the uninfiltrated lung, on the other hand, the so-called thickened and beaded bronchus is merely a normal but prominent blood vessel, whose smooth, sharp contour moreover, and gradually decreasing caliber give no suggestion of the irregular deposition of density about it that would be the result of an infiltration. The "beading" and "capping of trunks" is due, not to the small collections of enlarged or calcified lymphoid tissue at branchings, but to axially radiated branches arising from a trunk or larger branch that runs perpendicular to the axial beam of X rays (4).

*Childhood-type lesions.*—Tuberculous infiltrations of the childhood type that characteristically implicate grossly the associated lymph nodes are not uncommon in the colored adult, and, though rare, not unknown in the white. Such lesions are discussed elsewhere (4) and, for reasons of space, will not be described here. Suffice it to note that any lesion wherever situated in the lung that implicates the associated lymph nodes so that they are recordable is probably tuberculous. Apart from such associations of lesions a nonapical infiltration without conspicuous antecedent apical infiltration occasionally occurs in early adult life and very rarely in maturer years in a person having the calcification of a childhood infection or known to have a long positive tuberculin reaction. Such lesions usually occupy a small area of lung and excavate rapidly. They may then at once cause widespread dissemination or they may remain somewhat localized for months before producing extensive disease. They appear sometimes rather sharply outlined, sometimes with a soft, hazy border, as homogenous consolidations within which

develops a rounded cavity, which shows perhaps small but highly significant changes in contour in closely spaced serial films. Within the area of infiltration there are no denser islands or strands to suggest old scar tissue. All parts of the lesion have either a homogeneity or a softness—gradual melting into the surrounding lung—that suggest a recent lesion. Figures 7 and 8 illustrate a case in which there had been present for some months an apical lesion of largely dense supraclavicular strands. As shown here there is a small soft patch in the apex in addition to the excavated lesion. In many cases, especially in mature persons, careful exploration with apical exposures will show a few strands or salients, sharply demarcated and apparently for the most part of long standing. Such cases, like that illustrated in Figures 7 and 8, are, of course, of the adult type. In early adult life there may be no other infiltration in the apex or elsewhere. (See figs. 16, 17, 17a, and 43 of reference 4.) All such tuberculous lesions in contrast with lung abscess present signs and symptoms trivial in comparison to their anatomical severity. There is only moderate elevation of the polymorphonuclears and often little sputum, that may be negative to several examinations, then show large numbers of bacilli in one or two specimens only. The temperature and pulse may be normal or only transitorily elevated. Careful, closely spaced X-ray control is often necessary to follow and determine the course of the lesion. Pneumothorax or phrenicectomy should not be delayed more than a few weeks at most unless resolution and retrogression is prompt.

*The relation of X-ray appearances to signs and symptoms.*—About this topic many papers have been written and much will yet be said. Yet the logic of controlled observations is clear. Everywhere lives are being lost and needless permanent disability incurred because of failure to hospitalize and treat tuberculosis realistically as a process that destroys not by fever or râles, but by infiltration and excavation. Few agencies now exact a positive sputum as proof that a patient needs treatment. The records of sanatorium treatment long ago established that a patient who is treated only while his sputum is predominantly positive will give a poor therapeutic and economic result. Thereafter râles, and, still later, elevation of temperature and pulse were fixed upon as criteria of progressive tuberculosis. Those in charge of sanatoria, in particular Brown and Heise at Trudeau, who made a film at admission and a follow-up film after six months a measure of treatment, soon found that increased damage could occur without significant reflection in pulse, temperature, or physical signs. These are well established, even classical demonstrations. More recently it has been shown (2, 3, 4) that infiltration and excavation can progress for months, sometimes for years, before the development of noticeable signs, symptoms, or impairment of health. Moreover



100-1

FIGURE 7.—AN. FO., FEMALE, AGED 44, APRIL, 1930

Right: Dense strands in 2 and 3 post. i.s. Ill-delimited consolidation, somewhat homogeneous, and with a central rarefaction, from 8 to 9 post. rib. Scattered infiltration below this level. Left: Dense strands in 2 and 3 post. i.s. A pulmonary lesion whose shadow is, like this one, projected onto the film in close association with the hilum shadow, is usually anterior to it (for the most part in children) or posterior to it (chiefly in adults). No lesion should be described as in the hilum unless the hilum is actually its site. Physical signs, chiefly râles, were posterior. Temperature not elevated. Loss of weight of about 10 pounds in last few months. Cough slight, sputum positive.

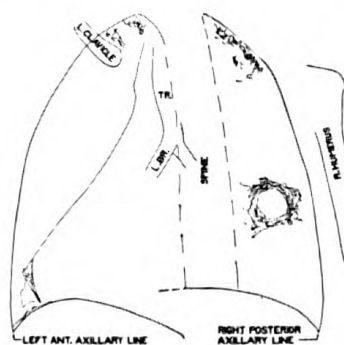
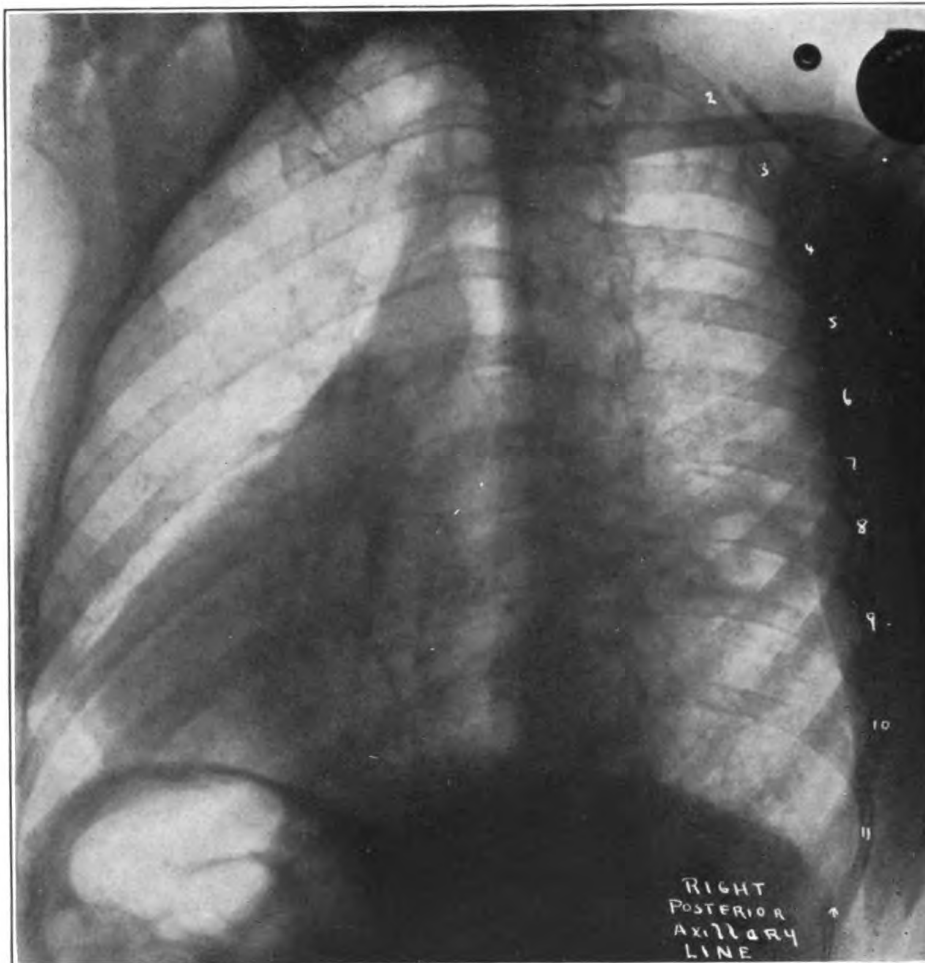


FIGURE 8.—AN. FO., ROTATION EXPOSURE OF  
FIGURE 7

The site of the cavity is clearly close to the posterior chest  
wall and not associated with the hilum.

100—2

lesions do not acquire anatomical stability for many months after these have subsided. Nevertheless standards of activity arbitrarily based upon these inexact criteria are still expected to protect the patient, to guide his treatment, to determine his capacity for exercise, his fitness for work, his eligibility for discharge, often to the neglect of the X-ray evidence. At best elevation of temperature or pulse, high white count, rapid sedimentation rate bear no direct, much less proportional, relationship to the underlying damage in the lung. They may by their presence accentuate the basic information, given by the X-ray film, of the extent, quality, and severity of a lesion; their absence, in whole or in part, can not invalidate it. Yet even to-day we hear some physicians advise patients—young adults at that—that no evidence of activity is afforded by a punched-out rarefaction in the midst of a homogeneous consolidation; or, again, that there are so few râles that a more hopeful view may be taken of the consolidation and excavation; or, again, that so slight a temperature means that the lesion is old. Even those who may not infer something of the mission of a structure from its conformation—to whom a destroyer and a tramp are alike—may be saved from error by serial, closely spaced views, when the rate and character of progression sufficiently reveal what must be dealt with. The tramp may be a mystery ship, and is worth a watchful eye—but the destroyer is all that its name implies.

To those who shrink from the expense of X-ray films sufficient to inform the physician as to what he is doing, it may be pointed out that the cost of an examination is about the cost of two days' hospitalization. Apart from the economic value of the patient and the importance of protecting him from preventable disability, adequate knowledge of the state of his lesion will reduce later hospital days. Certainly any young adult who can profit by hospitalization will gain more from informed treatment for 11 months than from mere boarding-house facilities for 12 months.

Characteristically during adolescence and early adult life and during certain stages of the disease in later years rapid progression and widespread destruction occur within a space of weeks, even of days. Yet frequently the official attitude to tuberculosis, as crystallized in available beds and their allocation, is that the process is a slow waiting game and that long hospital waiting lists are quite appropriate. There is often a priority, a precedent, even a certain decorum to be observed about admission, while the tubercle bacillus destroys the areas in which it is established and entrenches itself within new terrain.

*Signs and symptoms with trivial or ambiguous X-ray lesions.*—These may be (1) positive sputum, (2) hemoptysis, (3) persistent cough.

(1) Positive sputum is decidedly rare in the absence of a clearly definable infiltration. When the apices show no lesion careful search should be made of the retrocardiac and retrodiaphragmatic areas and, especially on the right, the lung behind and in front of the hilum, particularly in early adult life. In these sites acute tuberculous consolidations ranging from three centimeters to five or six centimeters are not hard to overlook. The center usually shows a more or less spherical rarefaction or a somewhat moth-eaten appearance. These are dangerous lesions and should be closely followed.

In another type of case positive sputum has occurred with no other abnormality than a strandlike patch about four centimeters across at the anterior first interspace. This lesion did not increase nor did dissemination occur. The patient has been well and working for five years.

(2) Small and moderate hemoptyses may occur at intervals of three months to a year over a period of years in association with a strandlike and anatomically stable lesion. Such patients need supervision but not always hospitalization. It may also result from an inconspicuous fresh infiltration such as noted under positive sputum. Apart from tuberculous infiltrations hemoptysis may come from a nontuberculous lesion whether acute or chronic. Such infiltrations (4) are usually densest just above the diaphragm, behind the left cardiac shadow or close to the right cardiac border. In most cases careful examination of these areas will disclose double-contoured, often somewhat irregular, lines which are due to slight bronchiectasis within an infiltration area. In all cases such double-contoured lines should be traced back into the main stem bronchus; otherwise one must mistrust the diagnosis. Lipiodol if injected into the area may verify the diagnosis but it must be remembered that both hemoptysis and sputum can come from a nontuberculous pulmonary infiltration within which the bronchiectasis is slight and secondary. In some cases these hemoptyses are associated with a dry cough. When there is constant sputum, there is an unmistakable infiltration beside the heart or upon the diaphragmatic contour, with the anatomical characteristics of nontuberculous lesions (4).

(3) Persistent cough may be due to the lesion just described or a lesion in an extrapulmonary location, such as the sinuses. In many doubtful cases serial X-ray examinations alone will solve the problem. It is very rare that cough or symptoms arise from a tuberculous lesion that escapes adequate X-ray examination. Care should also be taken, especially in middle age and later, not to assign the cause of cough to old, dense, sharply demarcated strands without exhaustive search for a nontuberculous basal lesion or a lesion of the sinuses. Such stable apical strandlike lesions, supraclavicular for the most part, associated with a basal nontuberculous lesion and

occurring in the middle-aged, probably constitute the vast majority of the so-called benign clinical tuberculosis. Failure to diagnose the real cause of the symptoms—the basal nontuberculous lesion—has led not a few writers into a contempt for apical strands that very often causes disaster when they occur in the young adult. In early adult life no apical infiltration, however strandlike, can be safely ignored. (See figs. 25, 26, 34, and 35 of reference 4.) Nor should the trained and valuable middle-aged patient be saddled with a diagnosis of tuberculosis, even if he is assured it is benign, when what he needs is treatment for the nontuberculous cause of his symptoms.

#### SUMMARY

In the foregoing pages there have been presented the technical methods and the evidence for making the roentgenogram the basic diagnostic and therapeutic guide in tuberculosis. To become dependable, the X-ray records must be made with due regard to the physical, anatomical, and physiological factors involved and must be examined exhaustively, so that a definite anatomical diagnosis may be reached before its full interpretation is sought in the light of other diagnostic evidence. The films should be first examined for all the information they may yield to a mind unprejudiced by inevitable deductions from other information. Such a procedure, at first, takes longer, but only so will the film be thoroughly searched and its technical defects perceived. There is ample reward in more accurate perception of the normal structural range and in the discovery and differentiation of those characteristics of relation to the site, of form and quality of the lesion, that, although not pathognomonic, are yet usually of major diagnostic importance. Even in the upper third rarefaction may be characteristically nontuberculous and in the lower third an isolated cavity typically tuberculous. Likewise nonapical infiltrations, especially in childhood, have predilections of site and qualities of shadow that in many cases are sufficient to direct treatment, in the lack of supporting decisive evidence, along the more rewarding way earlier than can be done if all shadows are regarded solely as evidence of obstruction of the X ray. In medicine the tour de force type of X-ray reading, which would exclude any other information that might weigh in diagnosis, can not be other than trifling and frivolous, but may not something be urged for the integrated analytical report from adequate X-ray records? Those who reason an opinion from evidence are always subject to error, but not to error irremediable by proper follow up by all diagnostic methods. On the other hand, when other evidence is lacking or lags, one can often prevent great economic loss by recognizing the immediate menace of one type of shadow, the more remote and more easily controllable threat of another.

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HEALTH CONDITIONS IN AMERICAN SAMOA

## REPORT OF THE HEALTH DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1930

By W. W. HARGRAVE, Commander, Medical Corps, United States Navy; Senior Medical Officer, United States Naval Station, Tutuila, Samoa

The total number of deaths from all causes during the year 1930 was 177, making the crude death rate 17.73 per 1,000. This rate is based on the population of 9,985, which is exclusive of Swains Island and United States naval station personnel. The total number of deaths for the year 1929 was 213, making a crude death rate of 21.39 per 1,000 for that year, which is 3.66 per 1,000 higher than for 1930.

The present system of collecting vital statistics is such as to make it unlikely that any births or deaths are not reported. This system became reliably operative May 1, 1928. A triple check is made on all births and deaths in American Samoa. The pulenuu's of each village are required to submit birth and death reports immediately upon the occurrence of a birth or death to their respective district health officers. The district nurses are also required to submit a report of birth or death to their district health officers and the nurse's report is used as a check against the pulenuu's report. On the first of each month these reports are forwarded to the central public health office, where they are again checked for errors. It has been necessary during the year to send several village pulenuu before the secretary of native affairs for failure to report births and deaths. By taking this disciplinary action the importance of sending in these reports



has been impressed upon the various village chiefs. This system of collecting birth and death statistics is operating very satisfactorily and we feel that it is impossible for a birth or death to be omitted.

The following table shows the indicated crude death rates for the past eleven years to and including 1930. As stated above, mortality statistics became reliably operative in 1928. The census of American Samoa, completed in March, 1930, gives an actual population of 9,768. During the year there was an increase of births over deaths of 217. This figure added to 9,768 gives us a present population of 9,985. Emigration from and immigration to American Samoa is of such little consequence that it has very little bearing on vital statistics. The statistics as set forth in this report are based on this figure.

Year	Population	Deaths recorded	Indicated crude death rates	Year	Population	Deaths recorded	Indicated crude death rates
1920.....	8,056	67	8.32	1926.....	8,676	237	27.32
1921.....	8,161	115	14.09	1927.....	8,724	183	20.98
1922.....	8,264	152	18.39	1928.....	8,945	136	15.20
1923.....	8,367	229	27.37	1929.....	9,768	213	21.81
1924.....	8,470	120	14.17	1930.....	9,985	177	17.73
1925.....	8,573	145	16.91				

It is not likely that all deaths were reported prior to 1928. The health department did not take an active part in the collecting of mortality statistics and causes of death were not registered before that date.

*Death by sex and age groups.*—Few Samoans know their exact age. Ages are determined by close inspection of their person and appropriate questions. Therefore it is readily seen that tables based on age groups represent no great degree of accuracy.

The following table shows all deaths which occurred in American Samoa during the year 1930, arranged according to sex and quinquennial age groups:

Age group	Male	Female	Total	Per cent	Age group	Male	Female	Total	Per cent
Under 5 years....	30	34	64	36.15	55 to 59.....	3	3	6	3.38
5 to 9.....	1	0	1	.57	60 to 64.....	6	7	13	7.34
10 to 14.....	2	5	7	3.95	65 to 69.....	2	1	3	1.69
15 to 19.....	5	4	9	5.08	70 to 74.....	3	6	9	5.08
20 to 24.....	6	2	8	4.53	75 to 79.....	1	1	2	1.13
25 to 29.....	2	6	8	4.53	80 to 84.....	1	0	1	.57
30 to 34.....	7	1	8	4.53	85 to 89.....	1	0	1	.57
35 to 39.....	9	4	13	7.34	90 to 94.....	1	0	1	.57
40 to 44.....	5	2	7	3.95	Total.....	93	84	177	100.00
45 to 49.....	5	4	9	5.08					
50 to 54.....	3	4	7	3.95					

*Deaths by race and occupation.*—Of the 177 decedents, 166 were full-blooded Samoans; 1 was a Japanese-Samoan half-caste; 3 were white American-Samoan half-castes; 2 were German-Samoan

quarter-castes; 3 were British-Samoan quarter-castes; 1 was a Tekelau Islander; and 1 was an Ellice Islander. The occupational status was recorded as follows: Infants, 41; children, 27; students, 7; plantation workers, 41; houseworkers, 28; missionaries 4; fitafitas, 2; storekeeper, 1; and no occupation, 17. The ages of the 17 having no occupation were recorded as 52, one; 55, two; 60, two; 68, one; 70, three; 71, one; 74, one; 75, two; 82, two; 88, one; and 91, one.

*General death rates by islands.*—The Tutuila death rate from all causes was 17.44 per 1,000. That of the connecting islands of Ofu and Olosega was 23.93 and that of the island of Ta'u was 15.79.

The death rate for the eastern district of Tutuila was 10.79; for the central district, 18.85; and for the western district, 18.54.

*Infant and child mortality.*—The infant mortality rate for American Samoa in 1930 was 104.07, representing deaths under one year of age per 1,000 living births. The corresponding rate for the island of Tutuila was 111.11; for Ofu-Olosega, 108.10; and for Ta'u, 57.69. With regard to the island of Tutuila, the death rate for the central district was 137.93; for the eastern district, 92.59; and for the western district, 84.90.

In explanation of the high death rate in the central district of Tutuila it should be noted that the Samoan hospital is located in this district where obstetrical cases are admitted and to which a certain number of infants are transferred for treatment.

In American Samoa, during 1930, 41 infants died before reaching the age of one year. This is a decrease of 7 over that of 1929. The causes of death were as follows:

Pneumonia (all forms).....	11
Acute infectious enterocolitis.....	11
Dietary deficiencies.....	6
Influenza.....	2
Congenital causes.....	3
Premature birth.....	2
Erysipelas.....	1
Encephalitis, acute influenzal.....	1
Ascariasis.....	1
Tuberculosis, chronic general.....	1
Meningitis, acute.....	1
Hemorrhagic disease of new born.....	1

Between the ages of one year and five years, 23 deaths occurred as follows:

Age	Male	Female	Total	Per cent of total deaths	Age	Male	Female	Total	Per cent of total deaths
1 to 2.....	6	6	12	6.78	4 to 5.....	0	1	1	.56
2 to 3.....	3	4	7	3.95	1 to 5.....	11	12	23	12.99
3 to 4.....	2	1	3	1.69	All under 5.....	31	33	64	36.15

In the quinquennial age group 5 to 9 there were 3 deaths, 1 male and 2 females. The causes were: Tuberculosis of the brain, 1; tuberculosis, chronic pulmonary, 2.

In the age group 10 to 14 years there were 6 deaths, 2 males and 4 females. The causes were: Tuberculosis, chronic pulmonary, 3; pneumonia, lobar, 3.

In the age group 15 to 19 years there were 8 deaths, 4 males and 4 females. The causes were: Pneumonia, broncho, 2; meningitis, influenzal, 1; tuberculosis of the joints, 1; erysipelas, 1; influenza, 2; abscess of breast, 1.

#### DEATHS BY CAUSES, ALL AGES

*Tuberculosis.*—Tuberculosis in its various forms caused 35 deaths during the year 1930, making the death rate 350 per 100,000. The death rate for the year 1929 was 422 per 100,000, which shows an appreciable reduction for the year 1930. Tuberculosis has been the leading cause of death for several years, but pneumonia caused more deaths than tuberculosis during the year 1930. The following table shows the sex, age, and place of residence of the decedents by districts, as well as the primary and secondary cause of death.

Sex	Age	District	Primary cause of death	Secondary cause	Deaths
Male...	11 months	Ofu...	Tuberculosis, general	None	1
Do...	1 year	Western	Tuberculosis, chronic, pulmonary	Gastroenteritis, acute	1
Do...	2 years	do	do	None	1
Female...	3 years	Ta'u	do	do	1
Male...	6 years	Central	Tuberculosis of brain	do	1
Female...	8 years	Western	Tuberculosis, chronic, pulmonary	do	1
Do...	10 years	Eastern	do	do	1
Do...	11 years	Ofu	do	do	1
Male...	13 years	Western	do	do	1
Female...	do	Ta'u	do	Tuberculosis, inguinal gland	1
Male...	17 years	Central	Tuberculosis of joints	None	1
Do...	18 years	Western	Tuberculosis, chronic, pulmonary	do	1
Do...	24 years	Ofu	do	do	1
Do...	do	Central	do	do	1
Female...	25 years	Ofu	do	do	1
Do...	26 years	do	do	do	1
Do...	29 years	Central	do	do	1
Do...	do	Ta'u	do	do	1
Male...	do	Central	do	do	1
Female...	37 years	Ofu	do	do	1
Do...	38 years	Eastern	do	do	1
Do...	39 years	Central	Tuberculosis, general	do	1
Do...	42 years	Eastern	Tuberculosis, chronic, pulmonary	Pulmonary hemorrhage	1
Male...	43 years	Western	do	None	1
Female...	45 years	do	do	do	1
Do...	46 years	do	do	do	1
Male...	47 years	Central	do	do	1
Do...	49 years	do	do	do	1
Female...	50 years	Western	do	Tuberculosis, adenitis	1
Do...	51 years	do	do	Mitral insufficiency	1
Do...	52 years	Central	do	None	1
Do...	59 years	do	do	Pneumonia, lobar	1
Do...	62 years	Ta'u	do	None	1
Do...	do	do	do	do	1
Male...	70 years	do	do	Filariasis	1
Total					35

By public health districts, tuberculosis death rates were: Central district, Tutuila, 284 per 100,000; eastern district, Tutuila, 215; western district, Tutuila, 349; Ta'u district, 474; Ofu-Olosega district, 653.

*The pneumonias.*—Pneumonia (all forms) was the leading cause of death in American Samoa, causing 40 deaths during the year 1930. The death rate was 400 per 100,000.

The following table shows the sex, age, and place of residence of the decedents by districts as well as the primary and secondary cause of death.

Sex	Age	District	Primary cause of death	Secondary cause	Deaths
Female	1 month	Central	Pneumonia, broncho	None	1
Do	2 months	do	do	do	1
Male	4 months	Ofu	do	do	1
Female	do	Western	do	Malnutrition	1
Do	5 months	Central	do	None	1
Do	6 months	do	do	do	1
Male	do	do	do	do	1
Female	7 months	do	do	do	1
Do	8 months	Western	Pneumonia, lobar	Gastroenteritis, acute	1
Do	9 months	Ta'u	Pneumonia, broncho	None	1
Male	10 months	Central	do	do	1
Female	1 year	Western	do	do	1
Do	do	Central	do	do	1
Male	18 months	do	do	Influenza	1
Do	2 years	Ta'u	do	None	1
Do	do	Western	do	do	1
Female	do	do	do	Malnutrition	1
Male	3 years	Central	do	None	1
Female	5 years	do	do	Endocarditis	1
Male	10 years	do	do	None	1
Female	do	Ofu	Pneumonia, lobar	do	1
Do	13 years	Western	do	do	1
Male	17 years	Central	Pneumonia, broncho	Influenza	1
Do	18 years	Western	do	Abscess of lung	1
Female	20 years	Central	do	Premature labor	1
Male	23 years	do	do	None	1
Do	28 years	do	do	Filariasis	1
Do	32 years	Western	Pneumonia, lobar	None	1
Do	34 years	do	do	do	1
Female	35 years	do	do	do	1
Male	36 years	Central	Pneumonia, broncho	do	1
Do	do	do	Pneumonia, lobar	do	1
Do	do	Western	do	Filariasis	1
Do	39 years	Central	Pneumonia, broncho	None	1
Do	do	Western	do	do	1
Do	43 years	do	Pneumonia, lobar	do	1
Female	45 years	Ofu	Pneumonia, broncho	do	1
Do	48 years	Central	Pneumonia, lobar	Premature labor	1
Male	60 years	Western	do	None	1
Female	do	Central	Pneumonia, broncho	Polyarthritis, acute	1
Total					40

By public health districts pneumonia death rates were: Central district, Tutuila, 591 per 100,000. No deaths from pneumonia were recorded from the eastern district, Tutuila. Western district, Tutuila, 489; Ta'u district, 158; Ofu-Olosega district, 366. For the island of Tutuila as a whole the death rate was 424 per 100,000.

Deaths from pneumonia occurred by months as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Central.....	4	2	2	2	2	1	0	1	2	1	2	2	21
Western.....	0	1	0	0	2	1	3	1	0	2	3	1	14
Eastern.....	0	0	0	0	0	0	0	0	0	0	0	0	0
Ofu.....	0	0	0	1	1	0	0	1	0	0	0	0	3
Ta'u.....	0	0	0	0	0	0	0	0	0	1	1	0	2
All districts....	4	3	2	3	5	2	3	3	2	4	6	3	40

*Filariasis.*—Filariasis was recorded as the primary cause of 19 deaths during the year 1930, making the death rate 190 per 100,000. By districts the death rates were: Central district, Tutuila, 168; eastern district, Tutuila, 144; western district, Tutuila, 174; Ofu-Olosega district, 217; and Ta'u district, 315.

The following table shows the age, sex, and place of residence of decedents by districts, as well as secondary cause of death in each case:

Sex	Age	District	Primary cause of death	Secondary cause	Deaths
Female.....	28 years.....	Eastern.....	Filariasis.....	Abscesses, filarial.....	1
Male.....	40 years.....	Western.....	do.....	Septicemia.....	1
Do.....	do.....	Central.....	do.....	None.....	1
Do.....	44 years.....	Western.....	do.....	Abscesses, filarial.....	1
Do.....	48 years.....	do.....	do.....	do.....	1
Do.....	do.....	Central.....	do.....	None.....	1
Do.....	50 years.....	do.....	do.....	Abscesses, filarial.....	1
Female.....	do.....	do.....	do.....	None.....	1
Do.....	56 years.....	Ta'u.....	do.....	Abscesses, filarial.....	1
Male.....	58 years.....	Ofu.....	do.....	None.....	1
Do.....	59 years.....	Ta'u.....	do.....	Abscesses, filarial.....	1
Do.....	62 years.....	Eastern.....	do.....	Infection about thoracic duct.....	1
Female.....	64 years.....	Central.....	do.....	do.....	1
Male.....	68 years.....	Ta'u.....	do.....	Abscesses, filarial.....	1
Female.....	70 years.....	do.....	do.....	Filarial fever.....	1
Do.....	71 years.....	Western.....	do.....	Septicemia.....	1
Do.....	72 years.....	Ofu.....	do.....	Senility.....	1
Do.....	74 years.....	Central.....	do.....	Septicemia.....	1
Male.....	82 years.....	Western.....	do.....	Abscesses, filarial.....	1
Total.....					19

EPIDEMIC, ENDEMIC, AND INFECTIOUS DISEASES OTHER THAN TUBERCULOSIS,  
PNEUMONIA, AND FILARIASIS

*Influenza.*—This disease was recorded as the primary cause of nine deaths during the year 1930, with the secondary causes as follows:

Pneumonia, influenzal.....	4
Septic endocarditis.....	1
Septic pyemia.....	1
Endocarditis, acute.....	1
Encephalitis, acute.....	1
Bronchitis, acute.....	1

All nine of these deaths occurred during the first three months of the year. During the latter months of 1929 an epidemic of influenza was experienced in American Samoa. In December, 1929,

12 deaths were attributed to this disease. It is evident that the epidemic extended into the early part of 1930 causing the 9 deaths attributed to influenza during the months of January, February, and March. There were no deaths attributed to this disease during the remaining months of the year.

*Encephalitis, acute.*—This disease caused two deaths during the year 1930.

*Tetanus.*—This disease caused two deaths during the year 1930.

*Septicemia, pureperal.*—This condition caused one death during the year 1930. Postpartum hemorrhage was recorded as the secondary cause.

*Abscess, breast.*—This condition caused one death during 1930. Thrombosis, cavernous sinus, was recorded as the secondary cause.

*Carbuncle, neck.*—This condition caused one death during 1930. Septicemia was given as the secondary cause of death.

*Meningitis, acute.*—This disease caused one death during 1930.

*Meningitis, influenzal.*—This disease caused one death during 1930. Influenza was given as the secondary cause.

*Yaws.*—Treponematosis was responsible for two deaths during the year 1930. Frambesial hepatitis was given as the secondary cause.

*Acute infections of the gastrointestinal tract.*—These diseases were responsible for 14 deaths during the year 1930, as shown in the following table:

Sex	Age	District	Primary cause of death	Secondary cause	Deaths
Female	3 weeks	Eastern	Gastroenteritis, acute, infectious	None	1
Male	3 months	Central	do.	Acidosis	1
Do.	do.	Western	do.	None	1
Female	6 months	do.	do.	do.	1
Do.	7 months	do.	Enterocolitis, acute, infectious	Septicemia	1
Do.	8 months	Central	do.	Improper feeding	1
Do.	9 months	do.	Gastroenteritis, acute, infectious	do.	1
Male	10 months	do.	Enterocolitis, acute, infectious	None	1
Do.	9 months	do.	do.	do.	1
Do.	10 months	Eastern	Gastroenteritis, acute, infectious	do.	1
Female	do.	Western	do.	do.	1
Do.	1 year	Central	do.	Samoa treatment	1
Do.	18 months	do.	do.	Improper feeding	1
Male	46 years	do.	Poisoning, food, acute	Toxemia	1
Total					14

#### GENERAL DISEASES NOT INCLUDED ABOVE

*Cancer and other malignant tumors (Class II).*—There were two deaths attributed to malignancy of the stomach and one death recorded as cancer of the breast.

*Status lymphaticus (Class II).*—This condition is recorded as having caused one death during the year.

*Diseases of the circulatory system.*—This class of diseases was responsible for 12 deaths during the year 1930, as indicated in the following table:



Sex	Age	District	Primary cause of death	Secondary cause	Deaths
Male...	35 years...	Ta'u...	Chronic cardiac disease, mitral stenosis.	Cerebral embolism.....	1
Do....	36 years...	Western.	Coronary disease.....	None.....	1
Do....	50 years...	Eastern.	Myocarditis, chronic.....	Arthritis, chronic.....	1
Do....	52 years...	Ofu...	Arteriosclerosis.....	Cerebral hemorrhage (Yaws)...	1
Female..	54 years...	Ta'u...	Myocarditis, chronic.....	None.....	1
Do....	60 years...	Western.	Arteriosclerosis.....	Coronary thrombosis.....	1
Male....	do.....	Ofu...	Myocarditis, chronic.....	Filariasis (asthma).....	1
Female..	do.....	Eastern.	do.....	Asthma.....	1
Do....	do.....	Ta'u...	do.....	None.....	1
Male....	65 years...	Western.	Arteriosclerosis.....	Chronic nephritis.....	1
Do....	70 years...	Ofu...	do.....	Coronary sclerosis.....	1
Female..	do.....	do.....	Myocarditis, chronic.....	Senility.....	1
Total..					12

*Diseases of the respiratory system.*—There were no deaths caused by diseases of this international class except pneumonia, and for our purposes pneumonia is regarded as a communicable disease and is accounted for elsewhere.

*Diseases of the digestive system.*—Dietary deficiencies of mixed character were reported as the primary cause of death in eight cases. One death was attributed to each of the following conditions during the year: Peritonitis, acute; intestinal obstruction; and cholecystitis, acute. Five deaths were attributed to ascariasis.

*Malformations.*—Congenital malformations and other congenital causes were recorded as causing six deaths during the year 1930. The causes were recorded as follows: Congenital defect of unknown character, 2; premature birth, 2; hemorrhagic disease of the new born, 1; and imperforate anus, 1.

*Senility.*—Senility was recorded as the cause of five deaths during 1930.

#### VIOLENT AND ACCIDENTAL DEATHS

*Suicides.*—There were no suicides in American Samoa during the year 1930. Deaths by accidental traumatism occurred as shown in the following table:

Sex	Age	Village	Nature of accident	Injury	Immediate cause of death
Female..	14 months.	Malaeloa	Fell in drainage ditch during heavy rain.	-----	Drowning.
Male....	22 years...	Aolouau..	Fell over cliff.....	Injuries, multiple, extreme.	Fracture of skull, other multiple fractures.
Do....	34 years...	Faleniu..	Fell on concrete floor..	Fracture of skull.....	Fracture of skull.
Do....	38 years...	Alofau..	Fell in the sea.....	-----	Drowning. This man was suffering with dementia.

#### BIRTH STATISTICS

In American Samoa during the calendar year 1930 there were 394 living births. Based on a population of 9,985, the birth rate was 39.45 per 1,000. Of the 394 births, 220 were males and 174 females.

With reference to race the distribution was as follows:

Full-blooded Samoans.....	367
White American-Samoan half-caste.....	14
White British-Samoan half-caste.....	7
White American, Japanese-Samoan quarter-caste.....	1
Filipino-Samoan half-caste.....	3
Negro-American-Samoan half-caste.....	1
German-Samoan half-caste.....	1
<b>Total.....</b>	<b>394</b>

Forty-three, or 10.9 per cent, of the births were illegitimate children. There were 10 still-births, but these are not included in the 394.

Birth rates by districts were as follows:

Geographical areas	Population	Births	Birth rates per 1,000 of population
Eastern district.....	1,390	54	38.85
Central district.....	3,552	145	40.82
Western district.....	2,858	106	37.09
Ofu district.....	919	37	40.26
Ta'u district.....	1,266	52	41.07

#### GENERAL ADMISSION RATES

District	New cases all causes	Annual rate per 1,000	New cases diseases only	Annual rate per 1,000	Injury cases	Annual rate per 1,000
Eastern.....	4,001	2,878.42	3,218	2,315.11	783	563.31
Central.....	13,828	3,893.02	9,233	2,599.38	4,595	1,293.64
Western.....	6,898	2,413.58	5,015	1,754.72	1,883	658.85
Ofu.....	5,081	5,528.84	3,921	4,266.59	1,160	1,262.24
Ta'u.....	4,876	3,861.80	2,894	2,285.94	1,979	1,563.19
<b>Total American Samoa.....</b>	<b>34,684</b>	<b>3,473.61</b>	<b>24,281</b>	<b>2,431.75</b>	<b>10,400</b>	<b>1,041.56</b>

This table is based on a population of 9,985, as follows: Eastern district, 1,390; central district, 3,552; western district, 2,858; Ofu district, 919; Ta'u district, 1,266.

The health of the Samoans has been excellent during the year. The general admission rates for diseases as shown in the above table are slightly less than those for the previous year, 1929. This slight decrease may be accounted for by the fact that during the calendar year 1930 there were no epidemics of influenza. The only epidemic experienced during 1930 was the epidemic of dengue occurring during the months of May, June, and the first 15 days in July. The admission rates for injuries show an increase over that for 1929. This is partly due to the fact that Samoans are handling mechanical



appliances more than in years past. The greater portion of this increase occurred in the central district, where the naval station is located.

Public-health education is rapidly becoming more general and the Samoans are acquiring the habit of appearing at clinics and reporting to the district nurses, illnesses and injuries even of a mild character. It should be understood that practically every home in American Samoa is visited at least twice a week by some representative of the public health department and that an opportunity is afforded to record practically all illnesses and injuries. This thorough inspection by trained personnel is responsible in a great measure for the apparently high admission rate.

*Treatments administered, all forms of disability*

	Central	Western	Eastern	Ofu	Ta'u	American Samoa
Injuries.....	7,504	4,339	1,248	4,139	4,300	21,530
Infected wounds.....	5,192	1,226	1,112	476	403	8,409
Skin diseases.....	7,692	4,102	1,139	3,067	1,664	17,664
Dressings for other reasons.....	2,388	1,120	1,477	732	2,790	8,507
Worm treatments.....	944	637	625	152	76	2,434
Yaws treatments neoinjections.....	458	630	349	596	387	2,420
Filariasis.....	550	720	406	248	973	2,897
Constipation.....	1,280	627	536	590	739	3,772
Indigestion.....	126	299	26	33	180	664
Common colds.....	2,140	2,679	547	369	1,161	6,896
All other treatments.....	1,827	4,360	3,034	3,180	2,360	14,781
Total treatments 1930.....	30,101	20,739	10,499	13,582	15,058	89,974

The above table shows the total number of consultations or treatments administered during attendance at clinics, combined with the treatments administered by district nurses in visits to homes. These figures do not include cases treated in the Samoan Hospital.

By public-health districts the ratios of treatments administered per 1,000 of population were as follows:

Eastern district.....	7,538
Central district.....	8,474
Western district.....	7,221
Ta'u district.....	11,100
Ofu district.....	14,837
American Samoa.....	9,016

The high rate in the above table for the Ofu district is due largely to the great number of cases of acute infectious conjunctivitis treated during the breadfruit seasons.

**COMMUNICABLE DISEASES TRANSMITTED BY EYE, NOSE, AND MOUTH  
SECRETIONS AND DISCHARGES**

*Catarrhal fever and common colds.*—New cases were reported by months as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	7	7	11	7	16	7	5	5	8	9	11	12	105
Central.....	35	62	48	41	41	8	29	10	31	30	35	15	385
Western.....	57	55	62	42	23	21	50	38	53	47	63	28	539
Ofu.....	10	10	19	11	14	33	15	17	21	22	22	15	209
Ta'u.....	37	15	15	28	7	1	12	6	21	9	79	6	236
Total.....	146	149	155	129	101	70	111	76	134	117	210	76	1,474

The above figures are slightly under those for 1929. The number of admissions, as in the previous year, was greater in the western district. Common colds occur fairly frequently.

*Acute tonsillitis.*—New cases were reported by months as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	0	0	0	0	0	0	0	0	0	0	0	0	0
Central.....	0	0	1	0	0	0	0	0	0	2	2	1	6
Western.....	0	0	2	0	1	2	0	1	1	1	3	0	11
Ofu.....	1	0	0	0	0	0	0	0	0	0	0	0	1
Ta'u.....	0	2	0	0	0	0	0	0	0	0	0	0	2
Total.....	1	2	3	0	1	2	0	1	1	3	5	1	20

This disease is not a common infection in American Samoa. It is noted that no cases occurred in the eastern district and only one case in the district of Ofu.

*The pneumonias.*—Cases were reported by months as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	0	0	0	0	0	0	0	2	0	1	0	2	5
Central.....	7	11	3	2	3	1	3	3	13	9	28	16	99
Western.....	6	6	2	5	1	2	3	2	6	3	7	3	46
Ofu.....	0	0	0	1	1	0	1	1	0	0	0	0	4
Ta'u.....	3	0	0	0	0	0	0	0	0	1	1	1	6
Total.....	16	17	5	8	5	3	7	8	19	14	36	22	160

There were 160 cases of pneumonia reported during the year 1930. The pneumonias caused 40 deaths, making the case fatality 25 per cent. The corresponding death rate for the year 1929 was 13.5 per cent. There was an increase in the incidence of pneumonia during the last quarter of the year 1930, particularly in the central and western districts. The virulence of the infection was greater than during the year 1929 as shown by the mortality rate of 25 per cent for 1930 and 13.5 per cent for 1929. Broncho-pneumonia was the predominating type of the disease during 1930. There were

221 admissions during 1929 as against the 160 during 1930. But during the year 1929 influenza was given as the primary cause of 24 deaths, whereas in 1930 only nine deaths were attributed to this disease. In analyzing these figures the difficulty in differentiating influenzal pneumonia from other types in the absence of a definite epidemic must be considered.

*Influenza.*—Cases were reported by months, as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	17	3	38	63	8	2	0	0	0	0	0	0	131
Central.....	26	26	37	62	7	2	0	0	0	1	1	0	172
Western.....	5	7	23	5	0	6	0	0	0	0	62	23	131
Ofu.....	2	0	0	0	0	0	0	0	0	0	0	0	2
Ta'u.....	0	0	0	0	0	0	0	0	0	0	0	0	0
Total.....	50	46	98	130	15	10	0	0	0	1	63	23	436

The above table shows 436 admissions for influenza during the year. During the month of April there were 125 cases reported from the central and eastern districts. At this time there was some doubt as to whether these cases reported as influenza were dengue. It is quite probable that they were the latter disease, as an epidemic of definitely determined dengue occurred in May, June, and July which started in the central and eastern districts. As dengue had not appeared in American Samoa in epidemic form for many years it was thought at first that we were dealing with influenza. These 125 cases were, therefore, probably misdiagnosed by the district health officers and nurses.

Diseases of the upper respiratory tract were much less prevalent in the Manua districts, namely, Ofu and Ta'u, than on the island of Tutuila. There were only two admissions in Ofu and none in Ta'u for influenza. We have reason to believe that there was practically no influenza in these two islands, though some few of the cases admitted as catarrhal fever may have been influenzal in nature.

*Cerebrospinal fever and other forms of acute cerebrospinal meningitis.*—There were no admissions for cerebrospinal fever during the year 1930, but two cases of acute meningitis were admitted to the Samoan Hospital. Both of these cases died. One was admitted with the classical signs and symptoms of acute meningitis. The spinal cell count was 4,800, and many pus cells and small gram negative bacilli were noted. Cultural characteristics of this organism were suggestive of the influenzal bacillus.

The second case was admitted with otitis, media, acute. The discharge from the ear suddenly stopped and the patient developed a stiffness of the neck. Spinal fluid was cloudy and coagulated spontaneously. Smear showed Gram-negative bacillus; no growth on culture.

*Chicken pox.*—Chicken pox is endemic in American Samoa. Twenty-two cases were reported during the year 1930. The disease as seen here runs a comparatively mild course. The natives do not attach much importance to it and I have reason to believe that it has been more prevalent during the past year than the number of admissions indicate.

*Smallpox.*—No case of smallpox has occurred in American Samoa in recent years. American Samoa has a compulsory vaccination law. It is the practice to vaccinate children in all of the schools every year and one or more good scars in a child is considered evidence of immunity. During the calendar year 1930 there were 613 persons vaccinated who did not show one or more good scars. The reactions were as follows: Primary or positive reactions, 357; accelerated reactions, 40; immunity reactions, 216. Of the 613 persons vaccinated none of them showed previous scars.

The public health survey completed April 1, 1930, shows that there were 5,764 persons in American Samoa with one or more good vaccination scars, or a percentage of 58.5 for the total population.

*Whooping cough.*—There were no cases of whooping cough reported in American Samoa during the year 1930.

*Acute infectious conjunctivitis.*—Cases of acute infectious conjunctivitis were noted in American Samoa during the year 1930 as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	12	5	6	12	13	14	15	19	6	5	4	5	116
Central.....	24	49	15	21	14	6	4	8	5	8	12	14	190
Western.....	37	34	43	23	23	11	35	15	8	29	11	15	284
Ofu.....	57	57	48	27	25	36	32	30	42	33	46	50	493
Ta'u.....	76	22	32	11	25	25	22	24	43	26	18	26	350
Total.....	206	167	144	94	100	92	106	96	104	101	91	110	1,413

There were recorded 1,413 cases of Samoan conjunctivitis during the year 1930; 3,361 cases were reported during the year 1929. There was a uniform decrease in the number of admissions throughout American Samoa, with the exception of the eastern district of Tutuila. The improvement as regards number of admissions was more marked in the districts of Ofu and Ta'u. The natives are becoming more educated in regard to the spread of this disease and are more prompt in reporting cases in order that treatment may be instituted early. Early treatment and the carrying out of recommended preventive measures no doubt account for the reduction in the number of cases of this disease. The number of monthly admissions seems to indicate that this condition was more or less uniformly prevalent through the year and that there was not the usual high

admission rate during the breadfruit season, as has been reported in the past.

A very able discussion of the so-called Samoan conjunctivitis can be found in the Annual Sanitary Report for the year 1928, submitted by Commander J. R. Phelps, Medical Corps, United States Navy. This condition is an acute inflammation of the eyes, which is more prevalent during the breadfruit season when flies are numerous. The conjunctiva and the cornea are both frequently involved and serious consequences to the eye result either from neglect or from the native Samoan treatment.

The Health Department Survey completed April 1, 1930, shows that there are 270 persons of all ages in American Samoa who are blind in one eye, or 2.92 per cent of the total population and that there are 99 persons totally blind, or 1.07 per cent of the total population. The percentage of blindness is high and is largely attributable to Samoan conjunctivitis and the Samoan or native practices that ensue. The district health officers, nurses, Faifeaus and Puluenuus are provided with and instructed in the use of a silver solution for this disease which if used in time should shorten the duration of the attack, reduce the chances of spreading the infection and materially mitigate the end results that follow Samoan practices.

*Tuberculosis.*—New cases were detected during the year 1930 as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	1	0	0	0	1	0	0	0	0	0	0	0	2
Central.....	5	2	3	1	0	2	4	1	1	5	2	4	30
Western.....	2	3	3	2	2	3	5	0	0	0	0	1	21
Ofu.....	1	0	3	0	0	1	0	0	1	0	0	0	6
Ta'u.....	0	0	0	0	0	0	1	0	0	1	0	1	3
Total.....	9	5	9	3	3	6	10	1	2	6	2	6	62

There was a total of 62 new cases reported during 1930 as compared with 80 reported during the year 1929 and 78 reported for the year 1928. The death rate per 100,000 was 350, with 35 deaths, showing 1.08 cases per death. The death rate for the year 1929 was 422 per 100,000 with 39 deaths. Tuberculosis caused 19.7 per cent of the total deaths in 1930; 18 per cent in 1929; and 23 per cent in 1928. These figures show that tuberculosis has not increased in American Samoa during the past three years, but has diminished slightly. This improvement is attributed to the educational and preventive measures carried out by the public health department and the effort made to isolate and treat as many cases as possible under existing conditions at the Samoan Hospital.

According to Lambert and Phelps, tuberculosis is a disease of great importance throughout Melanesia and Polynesia. (An article

entitled "Tuberculosis in American Samoa" was published in the United States Naval Medical Bulletin, Vol. XXVIII, No. 2, April, 1930.) The old residents and missionaries maintain that the incidence of tuberculosis was negligible before the advent of the white man, and the evidence at hand seems to indicate that there has been a very steady increase during the past 30 years.

Capt. G. F. Cottle, Medical Corps, United States Navy, in a report to the Board of Health of American Samoa on November 14, 1910, states, "The comparative rarity of tuberculosis here, already commented on in a recent report, gives cause for congratulation. The conditions for its dissemination, however, are excellent."

Capt. E. U. Reed, Medical Corps, United States Navy, in the Monthly Sanitary Report dated March 31, 1912, states, "Tuberculosis has increased very much in American Samoa recently, and two members of the Fitafta Guard are now under treatment and have just been surveyed because of this disease."

Lieut. Commander C. C. Kress, Medical Corps, United States Navy, in his Annual Report for the fiscal year 1923 states, "Tuberculosis occupies a prominent place among the diseases treated in American Samoa. It is increasing and there are now 170 known cases."

The lack of racial immunity as pointed out by Lambert and Phelps, the disregard of ordinary hygienic measures in the home, the kava ceremonies as commonly practiced, the ignorance of the people at large in regard to the nature of the disease and the lack of appreciation of recognized preventive measures, and the tendency to object to isolation explains the high incidence of the disease here, as is probably true throughout a greater part of Melanesia and Polynesia.

There is no doubt but that tuberculosis is a serious problem that confronts the Samoan people. However, the statistics for the last three years are encouraging, and there is in the problem a field of endeavor of public health importance which should produce better results in the next few years. We are doing what we can in the way of preventive measures such as thorough instruction of field nurses in the recognition of tuberculosis and preventive measures to be carried out in the home, but I believe that the solution lies in prompt detection and isolation of the individual case at some central point. The Samoan Hospital has been enlarged and improved during the past year, and as far as bed capacity is concerned there is room for 15 tuberculous patients. It will be necessary to establish a system of messing at the hospital whereby patients can be fed and receive the proper diet that is so essential in the treatment of tuberculous cases. Under present conditions patients are brought to the hospital and the parents or relatives bring food to them from their

homes. This system is very unsatisfactory. It results in the presence of one and usually several members of the family at the hospital, which constitutes a distinct economic loss in that it takes them away from their routine home duties or work in the plantations. It also reacts against the welfare of the patient in that the inconvenience incurred creates a tendency on the part of the relatives to remove the patient. The establishment of a messing system at the hospital, the education of the Samoan people to the point of allowing patients to remain in hospital for longer periods, and the prompt detection of early cases of tuberculosis, followed by hospitalization until cured, will do more than anything that I know of to control this disease.

*Diphtheria.*—There were no admissions for this disease during the year 1930.

*German measles.*—No case of German measles was reported during the year 1930.

*Measles.*—No case of measles was reported for the year 1930. One case was reported from the eastern district for the year 1929. This is the only case of measles reported in American Samoa since the extensive epidemic that occurred in Fagatogo during the year 1926.

Available reports show that a serious epidemic of measles occurred in American Samoa in the year 1893. No mention is made of the number of cases. American Samoa was again visited by measles in serious epidemic form in the year 1911. The estimated population of American Samoa in this year was 6,667. There were 4,518 cases reported during this epidemic or 68 per cent of the total population, causing 219 deaths or a mortality rate of 4.8 per cent.

Lambert states that the earliest record he has found of measles in the South Pacific is the epidemic in the various islands of the New Hebrides in 1861. In that epidemic the island of Aneityum lost 1,000 people, about 33 per cent of the population. Lambert states that measles is endemic in Fiji, Western Samoa, Tonga, the Cook Islands, and the New Hebrides.

Measles is a disease of importance as regards general health in American Samoa, as it is not endemic and past records show that it occurs more or less periodically in epidemic form with serious consequences. Occurring as it has, periodically, no general resistance to this disease has developed and there are with each new generation a large number of nonimmunes. In view of the history of measles in American Samoa a close watch on incoming vessels for cases of this disease is a very important one.

*Mumps.*—One case of mumps was reported during the year 1930.

*Scarlet fever.*—There is no record of scarlet fever having occurred in American Samoa. No cases were reported during the year 1930.

*Leprosy.*—There are only two cases of leprosy in American Samoa.

These two cases are isolated at the Samoan Hospital. Another case is an inmate of the leper colony at Makogai. This colony, belonging to Fiji, is now administered through a cooperative plan between New Zealand, the British Western Pacific High Commission, and the Government of Fiji. The government of American Samoa is paying for the maintenance and care of this patient, the government of Western Samoa having refused to assume responsibility.

The two cases at the Samoan Hospital are of the mixed type and show positive nasal smears. Treatment with ethyl esters of chaulmoogra oil and iodine was carried out until March, 1931, when ethyl esters of calophyllum bigator was substituted. There has been very little change in the condition of these two patients, except that the man L. E. had an acute exacerbation of peripheral neuritis of the forearm in March of this year. The neuritis has improved during the past three months, but there remains some moderate contractures of the hands and an atrophic ulcer on the index finger of the left hand. Ephedrin, potassium iodid and cod-liver oil were used as adjuncts in the treatment of these cases.

*Bacillary dysentery.*—Bacillary dysentery occurred in American Samoa in epidemic form during the year 1911, causing 119 deaths. The type of dysentery is not reported, neither is the total number of cases given. However, it is stated that the mortality rate was 15.5 per cent, which would indicate that there were slightly over 800 cases reported. It is quite probable that bacillary dysentery occurred in American Samoa prior to 1911, but, there is no record of its occurrence available. A few cases are reported as having occurred from time to time during the period between 1911 and 1927. During the early part of 1927 an epidemic occurred affecting many villages throughout the island of Tutuila, the last recorded case terminating in recovery on the 3d of September, 1927. There were no cases reported during the years 1928, 1929, and 1930. During the spring of 1929 bacillary dysentery of the Shiga type occurred in Fiji in epidemic form and reoccurred in epidemic form in the spring of 1930. It occurred in epidemic form in Western Samoa (British) in January, 1931, and at the present time there are a few mild cases in and around Apia, Upolo (Western Samoa), but all reports indicate that the epidemic is practically over. The Shiga type was had in Western Samoa, as was also reported from Fiji. No figures are available, but judging from the information at hand, I am of the opinion that the type of dysentery had in Western Samoa and Fiji was not mild in character, but severe in its clinical manifestations, which you would expect from the Shiga type.

Old residents and natives are of the opinion that bacillary dysentery follows in the wake of a hurricane. This is probably true, and



can be accounted for in a measure as the result of the food shortage due to the damage to fruits and plantations by hurricanes.

Owing to the increase in the number of cases in Western Samoa and the food shortage in American Samoa, which followed the hurricane of January 15 and 16, 1931, a quarantine was established over Western Samoa on March 7, 1931. It is the common practice for many natives to make visits to and from Western Samoa.

A case of dysentery was discovered in the village of Vaitogi (western district) of American Samoa on March 11, 1931, in a child 5 years of age. This child was removed to the Samoan Hospital on March 12 and died a few hours after admission. This patient gave a history of having been sick for about seven days. A few days before this child was taken ill, another child in the same family who had recently returned from a visit to Apia, Western Samoa, was sick with fever and diarrhea for a period of four days. It is quite probable that dysentery was introduced into American Samoa by this family. These cases were discovered after quarantine over Western Samoa had been established. Another case of dysentery developed in a girl 17 years of age in the village of Fagatogo (central district) of American Samoa, on March 8, 1931. This patient had attended a party in the village of Vaitogi on the previous Sunday.

An autopsy was performed on the case from Vaitogi that died. The large bowel was involved throughout, from the rectum to the caecum. The mucosa of the entire large bowel was covered with a thick homogeneous, gelatinous, sanguinous exudate, with small pus pockets scattered here and there. The inflammatory process was limited to the mucosa and had the appearance of a coagulation necrosis. The mesenteric vessels were congested and the mesenteric glands were definitely enlarged, some to the size of a large pea. The microscopic study showed blood, pus cells, mucus and macrophages; cultures failed to show any dysentery organism. In the case from Fagatogo a bacillus was isolated which gave all morphological and cultural characteristics of the Flexner-Strong type. Another case was admitted from Mapusaga (western district) American Samoa on March 24, 1931, which gave all symptoms of bacillary dysentery, but was not proven bacteriologically. Local quarantine was established over the villages of Vaitogi and Mapusaga. No subsequent cases developed from these three cases during the month of March, which indicated little or no tendency to spread.

During the month of March a total of seven cases occurred in American Samoa. The original case at Vaitogi previously mentioned, one case from Tapitumu, one from Mapusaga, one from the village of Utulei, two cases from the village of Fagatogo and one case from the village of Alao (eastern district) American Samoa.

In April, 9 cases occurred, as follows: 1 from the village of Leone (western district), 2 from Tafuna (central district), 1 from Afono (central district), 1 from Tapitumu (western district), 2 from Fagatogo, 1 from Mapusaga, and 1 in a Samoan nurse at the Samoan Hospital, this last case the result of cross infection.

In May, 10 cases occurred. Two Samoan nurses at the Samoan Hospital contracted the disease as a result of cross infection, one case from Tafuna, where the disease had previously occurred. Another case was that of a child of the chief pharmacist living on the naval station. This case was traced to the cook boy, who a few days previously had an attack of diarrhea with fever. One case occurred in the young child of the Navy chaplain, also residing on the naval station, who during the week previous to the onset of his illness was known to have played on the beach in front of his home and was known also to have played in the ditch which drains the native village of Fagatogo. One case occurred in a French sister at the mission in Lepua, one in a member of the Fita Fita Guard who lived in the village of Fagatogo, one in Ofu, one in Ta'u in the Manua group, and one in Pavaiai, which terminated in death.

As has been stated before, this disease has shown very little tendency to spread and become epidemic in nature. This fact is due in part to the diligence shown in transferring all suspicious cases to the Samoan Hospital and to the cooperation of the Samoan people in bringing to the attention of the health department all suspicious cases and, also, to the nature of the organism which, apparently, is not a very virulent strain as far as dissemination goes.

*Symptomatology.*—The symptoms or clinical manifestations are rather severe. The course of the disease runs over a period of about three weeks, with fever, mucous and bloody stools and general abdominal pain, more marked over the large bowel. The stools are more or less typical with mucous, flecked with blood, and a microscopic picture of blood cells, pus cells, mucus, and macrophages. There has not been much tenesmus which indicates that the lower part of the rectum has not been involved in the majority of our cases. As was found in Western Samoa, a greenish stool was a characteristic feature of a great many of our cases. In these greenish stools you could always find quantities of blood-flecked mucous.

*Bacteriological findings.*—We have made cultures daily of all cases and were able to isolate the dysentery bacillus (Flexner-Strong type), in two cases. The inconsistency of our bacteriological findings or the difficulty of isolating the causal organism, brings up the question as to whether we are dealing with the Flexner-Strong type or whether we have an unusual strain which has been reported from Fiji and also Western Samoa.

*Treatment.*—All cases treated have responded very satisfactorily to treatment. Serum of a recent issue was used in all cases that appeared to be severe in nature. The diet used consisted principally of albumin, water, and milk. Water was given freely by mouth and a 5 per cent glucose solution was given by bowel. Small doses of saline and bicarbonate of soda were given three times a day by mouth. Serum was given both intravenously and intramuscularly.

The intravenous method gave the best results, particularly in the cases where treatment was started early in the disease. I prefer this method, especially if the manifestations of the disease are marked. No serum reactions of note occurred in the Samoan cases. In the two Navy children that were treated with serum intramuscularly, rather marked serum reactions (serum sickness) occurred about the fifth day after the first injection. One case was treated by giving serum by bowel, as outlined by Pedro T. Lantin, M. D., D. T. M., in an article published in the November, 1930, issue of the American Journal of Medical Science, covering a series of cases treated in the Philippine General Hospital. This case was the son of the Navy chaplain, age 5 years, and had a very severe form of dysentery. The temperature in this case was 105° during the first two days of illness, with severe bloody mucoid stools and abdominal pain. Shreds of mucous membrane were noted in the bloody mucoid stools. Realizing the serious nature of the case, serum was given twice daily in 10 c. c. doses intramuscularly and serum enemas were given three times daily after a cleansing enema of one and one-half per cent solution of bicarbonate of soda. The patient was able to retain the serum enemas for about two hours after each injection. He responded very satisfactorily to serum treatment. It is difficult to say whether the enema form of treatment had any efficiency or the response was due solely to the intramuscular injections or a combination of the two.

*Preventive measures taken.*—Quarantine was established over Western Samoa (British) to prevent its introduction into American Samoa. This quarantine was established before the first case was observed in American Samoa. The first case observed here was discovered a few days after the quarantine had been established. The family in which this case occurred having come to American Samoa on a boat arriving prior to quarantine. At first village quarantine was invoked as was done over the villages of Vaitogi and Mapusaga, but as this disease showed little or no tendency to spread this practice was discontinued and only house quarantine was resorted to. A description of the disease in all of its manifestations was published, and a special effort was made to find all cases of diarrhea or suspicious cases and transfer them to the Samoan Hospital for isolation and treatment. Swimming in the water of Pago Pago harbor was interdicted and special attention was given to the chlorine dosage of the water supply.

Precautionary measures were published for the information of the people at large and emphasis was laid on the importance of reporting all cases of diarrhea or frequent stools, in order that such cases might be investigated and the diagnosis of dysentery either proven or disproven and transfer made to the Samoan Hospital where warranted.

#### SUMMARY

1. Bacillary dysentery was most probably introduced into American Samoa by passengers arriving from Apia, Western Samoa, by boat on February 18, 1931.
2. Symptoms moderately severe in nature.
3. Disease showed very little tendency to spread and become epidemic in form.
4. Three deaths occurred in untreated cases.
5. Dysentery bacillus, Flexner-Strong type isolated in two cases. Numbers of cultures were made daily from stools of patients with negative results, except as noted above. The difficulty of isolating the causal organism was an

outstanding feature. The type of organism reported from Fiji and Western Samoa was the Shiga's bacillus.

6. The greater number of cases occurred among children and clinical manifestations were more severe in American children than in native Samoans.

7. The mortality rate was 11 per cent. It is quite possible that some mild cases were not reported. However, I feel quite sure that the number not reported was small as the Samoan people were exercised over the dysentery situation in view of past experiences with this disease and the knowledge of the severe nature of the epidemic in Fiji and Western Samoa, and cooperated thoroughly in reporting cases with the desire that they be transferred to the Samoan Hospital for treatment.

8. Intravenous serum therapy was the most satisfactory method of treatment. The serum reactions in Samoans were practically negligible. It was a practice at the Samoan Hospital to give a dose of magnesium sulphate following the injection of serum. The serum reactions (serum sickness) in the two Navy children treated was rather severe. Magnesium sulphate was not given to the Navy children.

*Entamebic dysentery.*—Entamebic dysentery is not endemic in American Samoa. One case was reported in 1928, and none since that time. A member of the crew of the steamship *Ventura*, Matson Navigation Co., was transferred during the month of November, 1930, to the Samoan Hospital, and a diagnosis of entamebic dysentery was established. This case greatly improved under treatment and was returned to his ship for duty after a period of six weeks in the hospital.

*Typhoid fever.*—Typhoid fever is endemic in American Samoa. During the year 1930 there were only five cases reported as compared with 12 cases during the year 1929. One case of paratyphoid occurred in the village of Nu'uuli during the month of February. Three cases of typhoid fever occurred in June, 1930, two from the village of Pago Pago and one from Tafuna. All of these cases were treated at the Samoan Hospital and the diagnoses were established by positive cultures. An additional case, a member of the crew of the steamship *Ventura*, Matson Line, was treated at the Samoan Hospital during the months of June and July, terminating in full recovery. There were no deaths attributed to typhoid fever during the year 1930.

#### COMMUNICABLE DISEASES TRANSMISSIBLE BY INSECTS AND OTHER ARTHROPODS

*Dengue fever.*—The widespread epidemic of dengue fever which occurred in May and June, 1930, was fully reported in last year's report and in a special report to the Bureau of Medicine and Surgery.<sup>1</sup> Only 11 cases have been reported during this fiscal year. Dengue fever is probably endemic in American Samoa at this time

<sup>1</sup> Published in United States Naval Medical Bulletin, Vol. XXIX, No. 3, July, 1931, pp. 565-572.

in a mild form, but no cases have come to the attention of the Public Health Department during recent months. The last known typical case was that of the wife of a naval officer who had the disease in the month of December, 1930, shortly after arrival on this station.

*Filariasis.*—The following cases of filariasis were reported from the various districts of American Samoa for the year 1930.

Eastern District.....	114
Central District.....	230
Western District.....	171
Ofu-Olosega District.....	29
Ta'u District.....	97
Total.....	641

Attention is called to the recapitulation of the health department survey as shown in the annual report of the Health Department of American Samoa for the year 1929. This survey brought out the fact that 665 persons in American Samoa are disabled anywhere from 5 to 6 days to 3 or 4 months a year by some manifestation of filariasis. Two hundred thirty-nine of these subjects have a well-developed elephantiasis. Four hundred twenty-six do not have elephantiasis, but have attacks of chills and fever (pueia), acute swelling (mumu), or filarial abscesses. Filariasis in the Samoan begins to manifest itself in one or more forms about 20 years of age. The greater number of cases are noted between the ages of 30 and 60. From infancy to the age of 20, Samoans are comparatively free from any serious form of the disease. However, the microfilaria are probably in the blood stream.

As shown in the above table, there were reported 641 cases of filariasis in all of its forms during the year 1930. During the year 1929 there were 874 cases reported. These figures show a reduction of 233 cases during the year 1930. I doubt very much if there were as many new cases during the year as shown above, as I have reason to believe that the old system of reporting new cases by district health officers and district nurses was not sufficiently thorough to preclude the reporting of cases as admissions which probably were in reality readmissions. A new system of reporting original admissions for filariasis has been inaugurated during the past six months, which requires such cases to be reported in such a manner as to show the name, age, sex, place of residence and manifestations of the disease. This record is kept on file at the respective district dispensaries and each new case reported is carefully checked to obviate repetition. I feel that this method of reporting original admissions, or new cases, will show the true status at the end of this current year, as regards the incidence of filaria.

Filariasis was given as the primary cause of 19 deaths during the year, which is the same number recorded for the year 1929. Tuber-

culosis and pneumonia give a higher death rate, but filariasis probably causes greater damage than any other disease by reason of the disabling effect and the undermining of general health which in a way predisposes to other infections.

Rigid sanitary inspections of all villages are made weekly by members of the public health department and every endeavor is made to keep mosquito breeding in and about the villages at a minimum. Blood examinations show that practically 60 per cent of the adult population have microfilaria in their blood. The health survey completed during the year 1930 shows that 13.5 per cent of the adult population above the age of 20 years have some serious manifestation of this disease. The reinfections as the result of repeated mosquito bites is the important feature as regards the continuation and propagation of this disease, and the only constructive preventive measure as far as I can see it, is that of mosquito control. The house-to-house inspections and the elimination of all source of breeding is the only method of control that facilities at hand afford. Abatement notices are frequently invoked. The *Aedes variegatus*, the principal vector of filariasis is a day biting mosquito and flourishes in the "bush," as well as in and around houses. The Samoans spend a great deal of their time in the "bush," at work on their plantations and obtaining food. At the present time, without funds or means for an extensive method of mosquito control, I see no way of improving conditions, other than previously mentioned.

The treatment of filariasis by injections of oil of chenopodium has been discontinued, in view of the reactions, antipathy on the part of Samoans to this treatment and the questionable results obtained. Oil of chenopodium may reduce the number of microfilaria in the peripheral blood and may shorten or moderate an acute attack, but I doubt if it has any marked effect on the parent worms, and then again reinfections follow.

*Yaws.*—Cases with active lesions during the year 1930 were reported as follows:

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	1	1	2	9	1	3	9	8	6	7	27	6	80
Central.....	23	43	0	17	14	2	8	28	6	8	11	12	172
Western.....	36	19	22	19	26	12	26	37	6	8	7	12	230
Ofu.....	6	21	5	19	13	5	6	6	4	14	5	6	108
Ta'u.....	1	24	3	14	14	12	1	4	1	1	2	12	89
Total.....	66	108	32	78	68	34	49	83	23	38	52	48	679

As shown in the above table, there were 679 admissions for yaws during the year 1930. During the previous year there were 1,040 cases reported and during the year 1928, 1,404 were reported. During 1929 a special effort was made to combat this disease and treat as

many cases as possible. This campaign against yaws has been continued to date, and the figures show a reduction of 400 cases during the year 1929 as compared with 1928 and a reduction of 323 cases during 1930 as compared with 1929, which shows a reduction of 723 cases reported for the year 1930, as compared with 1928. A system of reporting yaws by name, age, sex, and residence was started in March of 1931. District health officers are required to check each admission closely in order to obviate admissions when it should be a readmission and thus avoid duplication. It is possible that there were a few duplications in the past.

The health survey completed in March, 1930, shows that out of the total population of American Samoa, at that time 9,765, there were 5,719 persons who had yaws or who gave a history of having had yaws during childhood. The first quinquennial age group (0-4 years) showed 26 per cent had yaws or gave a history of having had yaws; the second quinquennial age group (5-9 years), 56 per cent; the third quinquennial age group (10-14 years), 68 per cent; and the seventh quinquennial age group (30-34 years), 75 per cent. A series of 214 Kahn tests were run on native Samoans, members of the Fita Fita Guard and natives employed at the naval station, by Commander J. R. Phelps, Medical Corps, United States Navy, and Lieut. H. H. Carroll, Medical Corps, United States Navy. In this series there were 195, or 91 per cent, 3 or 4 plus reactions and 19, or 9 per cent, negative reactions. It is reasonable to assume that 90 to 100 per cent of all adult Samoans living in the outlying districts under native conditions have had yaws.

Yaws as it occurs in American Samoa is principally a disease of children. In the age groups 5 to 14 years there were 2,553 children, 1,580 or 61.9 per cent of whom gave a history of having had yaws or had active yaws lesions at the time the survey was made.

The primary lesion or "mother yaw" is frequently seen in the outlying districts. It may be single or multiple from auto-inoculation and is almost invariably extragenital. The natives show no desire to have their children treated in this stage of the disease as they believe that yaws should not be treated until secondary lesions have developed, and this belief on the part of the natives is probably well-founded in view of Schobl's experiments, which showed that immunity to yaws developed slowly and is not well established before the third month, and that immunity develops rapidly during the secondary stage. Most of the cases treated here are children with secondary lesions, well distributed over the entire body with a predilection for the lips, anal region, buttocks, thighs, palms of the hands and soles of the feet. The lesions seen in this stage are papules and granulomatous nodules of various sizes. Some of these lesions are dry and covered with a greyish yellow crust, easily removed and fol-

lowed by bleeding or oozing of serum. Others are moist and present an irregular oozing surface. The mucous membranes are not involved. Crab yaws is frequently seen in children and responds readily to treatment.

Late or tertiary yaws is rarely seen in American Samoa. As regards tertiary yaws there is no such parallel in American Samoa as exists in Haiti, or as reported by Lambert as existing in Rotumah, a dependency of the British colony of Fiji, or as is believed to exist in other islands of the South Seas.

The following cases of tertiary yaws were noted during the past year:

*Case 1.*—A woman of 60 years, residing in the village of Tula, with definite manifestations of gangosa which has existed for a number of years in an arrested state.

*Case 2.*—A woman of 50 years, residing in the village of Fagatogo, who has definite nasopharyngeal changes with difficult phonation. This condition was probably arrested 25 years ago as a result of specific treatment and is nonactive at the present time. The case probably would have progressed to a gangosa stage but for treatment.

*Case 3.*—A boy of 17 years, residing in the village of Fagaalo, who has definite nasopharyngeal changes with difficult phonation and scarring of the face and nose, more or less typical of gangosa. The condition was arrested by treatment two years ago.

*Case 4.*—A man of 24 years, residing in the village of Amouli, who presents a deep indolent ulcer of the left leg which has existed for two and one-half years. This ulcer has responded to specific treatment on two occasions with recurrences.

*Case 5.*—A man of 55 years, who died during the year, having suffered from a very large, deep indolent ulcer of the left thigh, which resisted all treatment. This case was reported from Ta'u.

*Case 6.*—A woman of 25 years, residing in the village of Nu'u'uli, who presented a lesion of the forehead involving the skin and frontal bone. She was treated a few months ago with neoarsphenamine and responded very satisfactorily.

*Case 7.*—A boy of 15 years, residing in the village of Pago Pago, who presents a lesion of the lower third of the left leg with a discharging sinus and X-ray findings suggestive of yaws infection of the lower part of the tibia. Treatment has just been started in this case and the diagnosis has not been proven, but at this time I am of the opinion that it is a case of yaws.

*Case 8.*—A woman of 26 years, residing in the village of Olosega, who has a dactylitis of the left little finger, now under treatment.

*Case 9.*—A woman of 42 years, residing in the village of Pago Pago, who has a dactylitis of the left ring finger, now under treatment.

*Case 10.*—A man of 27 years, a member of the Fita Fita Band, who during this year while blowing a clarinet suddenly developed a paralysis of the right side of face, with loss of power in grip or right hand and definite weakness in the right leg, with complete aphasia. Spinal puncture showed globulin (Ross-Jones) positive. Cell count gave 30 per cubic millimeter. Spinal fluid, Kahn, was negative. Blood, Kahn, was 4 plus. Patient gradually improved, with apparent full restoration to health in three months time. He was given specific treatment and at the present time shows no effects from illness. I am of



the opinion that the paralysis was due to cerebral hemorrhage as a result of endarteritis of yaws origin. In this case there were no other findings of yaws, except positive history, positive blood, Kahn, and a moderate increase in spinal cell count. Neither was there any evidence of aortitis nor any kidney lesion. Blood pressure was normal.

*Case 11.*—Another case, a chief petty officer in the naval service, age 52, born in Boston, Mass., had resided continuously in American Samoa for the past 26 years with the exception of four months in 1926 when he was in Honolulu, and eight weeks in 1912, when he was in Sidney, Australia. There was no history of lues and no penile scar. He married a Samoan 21 years ago. His wife had yaws during childhood but had had no miscarriages or abortions. There were 11 healthy living children, all of whom had had early yaws. He was admitted to the sick list in July, 1930, with a well-developed anemia, numerous subcutaneous hemorrhages and hemorrhages from the mucous membranes and stomach. Repeated Kahn tests were four plus positive. The liver was considerably enlarged, the lower margin being three fingers breadth below the costal margin. In view of the negative history of lues, absence of penile scar, long residence in Samoa and the fact that the wife and all children had had yaws, a diagnosis of yaws, acquired, involving the liver, was made. It was realized at the same time that the condition might be lues acquired in early life before coming to Samoa. Improvement followed small injections of neocarsphenamine and potassium iodid and liver extract. The patient enjoyed good health with freedom from hemorrhages for a period of about six months and then was readmitted with an ulcer on the leg and a return of hemorrhages and a definite blood picture of pernicious anemia. The liver at this time had receded behind the costal margin and within a few weeks ascites developed and the patient ran a low-grade temperature. Diagnosis was changed to anemia, pernicious, in February, 1931. Condition gradually progressed, resulting in death on May 15, 1931.

The autopsy was limited to the abdomen at the request of the family. The cavity contained about one gallon of straw-colored fluid. The intestines were of a pale yellow color, thinned and streaked with hemorrhagic areas. The peritoneum over the abdominal wall was of a pale yellow color and showed numerous petechial hemorrhages. The omentum was adherent to an appendectomy scar.

The stomach was acutely dilated and contained about one pint or more of black fluid. There was a bluish hemorrhagic area about the size of a dollar in the anterior wall of the stomach near the pylorus with slight erosion of peritoneum over this area.

The liver was small and pale in color, weight 900 grams, and was hard and firm, with an irregular and nodular surface. The posterior inferior surface of the right lobe was adherent to diaphragm and posterior abdominal wall and had the appearance of being inflammatory.

The spleen was slightly enlarged, pale in color, greatly distended with blood and covered with numerous pearly white elevations, firm to touch and would not rub off.

*Diagnosis.*—Anemia, pernicious; cirrhosis of liver of yaws origin; dilatation of the stomach, acute.

In talking with old residents of American Samoa, including retired service men, I am of the opinion that tertiary yaws was quite prevalent years ago before the introduction of modern antiyaws treatment, and that the very few cases seen to-day can be attributed to the fact that there are practically no untreated cases.

Cardiovascular yaws in the form of aneurysm, aortitis or chronic valvular heart disease is extremely rare, as no cases have been reported or seen during the past year and the absence of substernal pain and aortic regurgitation in the age group 30 to 50 is striking, in a population of 10,000, where the blood Kahn reactions are positive in 90 per cent of adults.

No cases of general paresis, tabes dorsalis, or other forms of neurosyphilis have been observed during the year. In connection with the effect of malaria in the Tropics in abating the incidence of general paresis, it may be said that malaria does not exist in American Samoa. However, "pueia" or filarial fever is quite common and might have the same influence on paresis as malaria.

It is necessary to administer only two or three small injections of neoarsphenamine to children to clear up the "mother yaw" or secondaries. Very few return for further injections, unless there is a return of lesions. The Samoan has a decided antipathy to injections, and it is difficult to secure close cooperation on the part of parents, which is quite necessary for the conduct of an effective yaws clinic. This is particularly so if yaws is to be eliminated or brought under absolute control.

Prompted by the favorable results obtained in Haiti in the use of spirocide, an arsenical preparation in tablet form, and a favorable report on the treatment of yaws with the drug in one of the recent issues of the United States Public Health Reports, venereal section, 500 tablets were obtained under the trade name of Acetarstone. During the past month this preparation was administered to 25 children with skin manifestations of yaws, in the following manner: Well-nourished children between the ages of 2 years and 10 years were given one tablet of Acetarstone at 9 a. m., one tablet at 1 p. m., and one tablet at 6 p. m., and the same procedure was repeated the following day. This 2-day a week treatment was carried out for three weeks. The results were most satisfactory. All lesions cleared or showed marked improvement in two weeks time in all cases, with a gain in weight from one-half to three pounds in 11 of the 25 cases. Marked constitutional improvement was noted in all. No difficulty was experienced in getting the children to attend the clinic, and the parents were enthusiastic about the method, which is quite a contrast to their reaction to injections of neoarsphenamine.

In view of the previously mentioned favorable report upon the use of this preparation, and the very limited trial of it had here, I believe that there is a decided field for therapy in this form in American Samoa. The enthusiasm on the part of the native parents and the willingness on the part of the children to attend clinics will offset the increase in the cost of this preparation as compared with neoarsphenamine, and will do a great deal more toward eradicating

yaws than can ever be expected from neoarsphenamine, with the serious objection to the painful injections and the memory of accidents that followed some injections in past years when salvarsan was used instead of neoarsphenamine.

The cost of Acetarsons (spirocide) is much higher than neoarsphenamine. Eighteen tablets, sufficient for one course, over a period of three weeks, cost \$1.11. The usual course of neoarsphenamine consists of 3 injections. One tube of neoarsphenamine costs 0.11 cents and is sufficient on an average for two or more injections when treating children. The cost of syringes, needles, dressings, and other equipment will materially raise the initial cost of the neoarsphenamine. It may be roughly estimated that the equivalent treatment with Acetarsons is five times as great as that of neoarsphenamine. However, the other advantage of this method previously set forth are sufficient to warrant the further and more extensive use of Acetarsons.

An intensive campaign was carried on against yaws during the past year. The following table shows that 2,396 injections of neoarsphenamine were given during the year 1930 and that 1,114 were given in the period between January 1, 1931, and June 30, 1931.

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	72	17	14	9	11	18	46	41	21	34	34	32	349
Central.....	44	31	0	17	14	29	26	69	34	66	55	39	424
Western.....	85	37	32	51	56	33	45	54	47	98	45	57	640
Ofu.....	40	62	30	47	51	21	59	32	44	88	66	56	596
Ta'u.....	3	34	4	8	41	9	16	52	45	12	69	94	387
Total.....	244	181	80	132	173	110	192	248	191	298	269	278	2,396

#### VENEREAL DISEASES

*Gonorrhea.*—Gonorrhea exists in American Samoa. The following forms of this disease were reported for the year 1930 from the Samoan Hospital. No cases were reported from the outlying stations.

Gonococcus infection of urethra.....	1
Gonococcus infection, cervix-uteri.....	4
Gonococcus infection, epididymis.....	2
Gonorrheal arthritis.....	1

It is most probable that gonorrhea is more prevalent than these figures indicate, as it is believed that a certain number of cases are treated individually and never come to the attention of the health department. However, it may be said that gonorrhea is not much of a problem in American Samoa.

*Syphilis.*—No case of syphilis among the natives was seen during the year 1930 that could be clearly diagnosed as such.

### INTESTINAL PARASITES

*Ascaris lumbricoides*, whipworms, and hookworms are commonly found in American Samoa. *Ascaris lumbricoides* is the most prevalent type of intestinal parasite and may be found in most Samoans. Hookworms, *Nector Americanus* variety, is also found, but is not so general as the *Ascaris lumbricoides* or whipworms. Out of 469 stools examined at the central laboratory and Samoan Hospital, 67.59 per cent were positive for intestinal parasites. *Ascaris lumbricoides* showed 17.69 per cent; whipworms 17.05 per cent; hookworms 5.9 per cent and *strongyloides stercoralis* 2.34 per cent; *Ascaris lumbricoides* and whipworms 13.4 per cent; *Ascaris lumbricoides* and hookworm 0.85 per cent; hookworm and whipworm 2.34 per cent; *Ascaris lumbricoides*, hookworm, and whipworms 2.34 per cent and flagellates 5.3 per cent. It was not common to find hookworm in stool examinations prior to the occurrence of bacillary dysentery in March, 1931, but since that time the incidence of hookworm has increased and hookworm infestation was frequently associated with bacillary dysentery. It may be that the thorough examination of stools during the mild bacillary dysentery epidemic brought to light cases of hookworm infestation that otherwise would have been overlooked.

As regards hookworm infestations, the symptom complex, severe anemia, constitutional debility and edema, is not observed here as in other parts of the world. In other words, there is no marked debilitating effect in the Samoans from hookworm infestation.

The whipworm is quite common and in a great many cases simulates appendicitis. The low blood count and eosinophilia is sufficient for a differential diagnosis.

The following table shows the number of treatments for intestinal parasites, by months, during the year 1930.

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Eastern.....	86	80	40	4	106	22	2	29	3	151	67	11	601
Central.....	153	161	15	4	0	9	11	84	29	71	15	50	602
Western.....	30	6	88	118	37	17	12	92	38	40	27	31	536
Ofu.....	3	3	3	30	6	11	17	4	22	12	25	20	156
Ta'u.....	11	8	12	3	14	10	3	1	1	6	3	0	72
Total.....	283	258	158	159	163	69	45	210	93	280	137	112	1,967

During the first six months of the year 1931, 2,659 treatments for intestinal parasites were given.

### DISEASES OF THE SKIN EXCLUSIVE OF YAWS, TUBERCULOSIS, AND NEOPLASMS

Parasitic infections of the skin are fairly common in American Samoa, as is true in most tropical countries. The following diseases occurred and they are mentioned in order of frequency: Ringworm, impetigo contagiosa, furunculosis, pemphigus contagiosa, scabies, and

dermatitis, unclassified. Two cases of *tinea imbricata* in severe form were treated during the year. *Tinea versicolor* is extremely common in American Samoa.

The following table shows the number of admissions for ringworm and other diseases of the skin for the year 1930:

District	Ringworm	Other diseases of the skin	Total cases of skin diseases	Admission rate per 1,000 of population
Eastern.....	130	174	304	218.7
Central.....	94	336	430	121.1
Western.....	167	817	984	344.8
Oftu.....	430	511	941	1,023.9
Ta'u.....	270	474	744	587.7
American Samoa.....	1,091	2,312	3,403	340.8

Treatments were administered for skin diseases by districts, as follows:

District	Number of treatments	Treatments per 1,000 of population	Treatments per case
Eastern.....	1,139	819.4	3.7
Central.....	4,665	1,313.3	10.8
Western.....	4,203	1,488.2	4.2
Oftu.....	3,075	3,346.0	3.2
Ta'u.....	1,664	1,314.3	2.2
American Samoa.....	14,746	1,477.1	4.3

(TO BE CONTINUED)

#### THE RELATION OF PREVENTIVE MEDICINE TO THE NATIONAL DEFENSE AND THE INCIDENCE OF PHYSICAL DEFECTS IN A SELECTED GROUP <sup>1</sup>

By CECIL C. WELCH, Lieutenant (Junior Grade), Medical Corps, United States Navy

In the last seven years Navy medical officers have rejected for physical reasons 56 per cent of all the applicants for enlistment appearing before them in Providence, R. I. The rate for 1927-28 is higher.

This represents a group in which we would expect to find the best physical specimens, young males from 17 to 21 years of age. If this is a reasonable assumption, the number of defectives in the military ages of 21 to 31 (late war) would be much larger. It is true that in a national emergency the standard of requirement for military-naval service could be lowered so that a greater number might be found acceptable, but the defects would remain and efficiency would suffer as a result of their enlistment. Using the above figure as a criterion,

<sup>1</sup> This paper was submitted in 1929 but was not published because other papers had priority. The data and thought it presents are as applicable to-day as then.

the percentage of those in the complete population having disqualifying defects must be very high.

As the health of a nation is vital in war, the entire population having to contribute to the necessary resources and suffer hardships, it is of importance as preparation for such an emergency not only to build up the physical stamina of the citizenry in general but, as far as possible, to decrease the percentage of defectives among those arriving successively at military age. An analysis of the data in the experience here presented shows that far more than half of the defects could have been prevented. That the preventable should be accomplished is only emphasized by the fact that neglect of many of the conditions noted leads to increase in the particular defect or other disability and a higher incidence of major pathology in later years.

The data offered concern applicants for enlistment coming from Providence and Woonsocket, R. I., and Fall River and New Bedford, Mass., with a small number from surrounding Rhode Island and Massachusetts territory. The majority, however, were from Providence, and all were self-selected before examination<sup>2</sup> and in the age group 17 to 21 years. Pertinent statistics concerning the population from which the majority of these young men were drawn, according to 1925 figures, are as follows:

Population.—664,301 of a total State population of 679,260 is urban.<sup>3</sup>

Nationality.—26.9 per cent foreign born, of which 34,671 were Italians, 35,548 French Canadians, 26,000 English, 19,000 Irish.<sup>2</sup>

Education.—0.3 per cent of the children from 10 to 15 years illiterate.<sup>4</sup>

Industries.—Textile, jewelry and silverware, foundry and machine products, and rubber fabrication are the principal ones.

The record of physical examinations, 1922–1928, inclusive, shows a total of 7,395 applicants, of which 4,153 or 56 per cent were rejected for physical reasons, as follows:

Condition for which rejected	Number of cases	Per cent	Condition for which rejected	Number of cases	Per cent
Eyes:			Poor physique.....	83	1.12
Color blindness.....	208	2.81	Hernia, or tendency to.....	68	.92
Defective refraction.....	739	9.99	Skin diseases.....	62	.84
Other visual diseases.....	27	.37	Varicose and varicose veins.....	48	.65
Defective teeth.....	843	11.40	Phimosis.....	30	.41
Underweight.....	394	5.33	Tuberculosis or suspects.....	22	.30
Flat feet.....	276	3.73	Defective speech.....	21	.28
Ears:			Obesity.....	20	.27
Defective hearing.....	106	1.43	Mental diseases.....	16	.22
Other auditory diseases.....	170	2.30	Enlarged tonsils.....	15	.20
Underheight.....	265	3.58	Venereal disease.....	14	.19
Deformities.....	161	2.18	Undescended testicle.....	14	.19
Heart affections.....	131	1.77	Nasal abnormalities.....	12	.16
Hemorrhoids.....	87	1.18	Enuresis.....	12	.16
Albuminuria.....	84	1.14	Bronchitis.....	9	.12

<sup>2</sup> The obviously unfit will not apply for examination.

<sup>3</sup> 1925 figures of Providence Journal.

<sup>4</sup> Showing that this group had been subjected to the school inspections. The figure is as of 1920.

Other defects are grouped as follows: Low blood pressure, high blood pressure, enteroptosis, endocrine imbalance, hallux valgus, icterus, syphilitic suspect, stiff right elbow, atrophy of both testicles, neuroma, hypersensitiveness, leg wound, coccygeal fistula, redundant prepuce, hemiplegia, moron, pediculosis, and thyroglossal cyst, each one case or 0.01 per cent.

Excessive tremor, lymphadenitis, condyloma (anus), bromidrosis, goiter, and acute laryngitis, each two cases or 0.02 per cent.

Intoxication, pes cavus, glycosuria, and hammer-toe, each three cases or 0.03 per cent.

Chronic orchitis, 4 cases or 0.05 per cent.

Adhesions following operative scars, hydrocele, and ingrowing toe nails, each 5 cases or 0.06 per cent.

Pyorrhea and hypospadias, each 7 cases or 0.09 per cent.

Defective teeth caused 11 per cent of the rejections. The dental requirements are minimum, i. e., 20 sound teeth with 4 opposed incisors and 4 opposed molars. As a group these are preventable or correctable and the consequences of neglect in the development of further and other disease is far reaching.

Defective refraction caused 9.9 per cent of the rejections. Minimum requirement is 15/20 normal vision in each eye. This is not an excessive standard and ought to be realized in young men more generally than the records under consideration indicate. While many can carry on without trouble with one eye for a long time in civil life, Government service in the Navy exacts binocular vision and it is certain that the better eye will suffer from the burden if equal binocular vision is not secured early in the period of greatest demand upon the eyes. The majority of these cases of low visual acuity could be prevented or at least improved by early treatment or refraction alone.

Flat feet caused 3 per cent of the rejections. This condition is in large measure preventable or correctable.

Deafness and other auditory defects caused 3 per cent of the rejections. The group includes such conditions as chronic or acute otitis, media, mastoiditis, perforated drums, atresia, and tumors of the external canal, leading, particularly when neglected, to various degrees of partial or total deafness. As cause for rejection they are largely preventable by timely corrective treatment.

Heart affections caused 1.7 per cent of the rejections. However, the percentage of organic disease in this series is very low and it is believed therefore that this category of occasion for rejection is largely correctable, if not preventable.

Laryngitis, acute, caused 0.2 per cent of rejections but is a temporary condition and not likely to merge into a chronic inflammatory state unless frequently recurrent and neglected.

In addition to the above, the following in general are also preventable or correctable: Deformities,<sup>5</sup> hemorrhoids, hernia or tendency to, nasal abnormalities, skin diseases,<sup>6</sup> venereal diseases, enuresis,<sup>7</sup> enlarged tonsils, ingrowing toenails, obesity,<sup>8</sup> hydrocele, phimosis, poor physique, underweight, redundant prepuce, pediculosis, and pyorrhea. Of the men examined, 37.3 per cent were rejected for clearly preventable or correctable defects and 18.7 per cent were rejected for defects which were either unpreventable or uncorrectable—at least apparently so. Among the conditions considered not preventable or correctable color blindness is an outstanding example. Many visual defects, including some cases of preventable infections, and many abnormal conditions of various parts of the body due to accidents or other comparable incidents of life are unavoidable only in the sense of being the result of human ignorance, improvidence, or carelessness.

From this point of view albuminuria, high blood pressure, bronchitis, bromidrosis, defective speech, enteroptosis, endocrine imbalance, glycosuria, hypospadias, pes cavus, underheight, undescended testicle, low blood pressure, hallux valgus, icterus, syphilitics, deformity, atrophy of testicles, neuroma, hypersensitiveness, wound scars, coccygeal fistula, hemiplegia, moron, thyroglossal cyst, excessive tremor, lymphadenitis, condyloma (anus), goiter, intoxication, hammer-toe, and adhesions are not preventable or often correctable, either manifestly so or because the underlying cause is not determined or the result is problematical. They comprised 1.7 per cent of the defects of men examined.

The mental diseases coming under observation were not sufficiently differentiated to permit even conjecture as to preventability or correctability and the exact condition of those cases set down as tuberculosis or tubercular suspects is not known.

It is admitted that the view as to the preventability and correctability or otherwise of groups en masse, as given here, is open to argument. Cases of obviously correctable conditions comprise the larger percentage groups, however, and from personal experience in these examinations it is believed that the stated proportion (60 per cent) of the defects causing rejections which could be prevented or corrected, is not too high.

Under the local laws all school children are examined and their defects are noted and indicated for correction. Clinical and nursing facilities appear adequate for all classes. The question arises, has this situation been in effect long enough to justify the thought that it

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<sup>5</sup> Largely postural spinal curvatures.

<sup>6</sup> Largely chronic parasitic conditions. Many are enlisted after treatment.

<sup>7</sup> Many can be stopped by training if there is no pathology of urinary tract.

<sup>8</sup> Those showing glandular imbalance, etc., are less simple in management.



should have made obvious mark upon the age group included in this study. Perhaps not. However, in view of the increased interest among all classes in public health news and the intelligent and extensive advances made by health departments during the last two decades we may expect to see the above regrettable percentages of disability materially reduced.

It would seem that to make the desired goal speedily attainable education, not only general but of the individual personally, as to the truth about conditions and the advantages to be expected from cooperation with the proper authorities is necessary. An appeal to patriotism as well as self-interest should be included as an important consideration, and increased powers might be delegated to local health agencies as a means of adding weight to their recommendations.

In the matter of individual education attention may be called to the Navy recruiting service, scattered as it is throughout the entire country and seeing thousands of young men monthly. The psychologically opportune moment should not be neglected. At each station physical defects noted should be explained to the applicant and he might also be referred to the proper clinic or institution for corrective treatment. The important rôle in the educational campaign represented by such public-spirited service and the direct aid to defectives that such a system would accomplish can hardly be overestimated.

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### CARBON TETRACHLORIDE POISONING

#### REPORT OF CASES

By F. H. HAIGLER, Commander, Medical Corps, United States Navy

Of considerable interest to the naval service is the occurrence of several cases of poisoning by carbon tetrachloride aboard the U. S. S. *Lexington* in December, 1929. During the navy yard overhaul of the ship, a considerable quantity of this chemical in tin containers was received on board. It appears that while a number of the containers were rusty, none were noted in a leaky condition. The chemical was stored in a compartment below decks, entrance to which is by ladder from an overhead hatchway. Ventilation is by one small terminal blower and the air supply is poor.

It was later discovered that some of the containers had rusted through and some leaking of the contents had occurred. A storekeeper and five enlisted men therefore were assigned the task of removing the tins preparatory to emptying their contents into a gasoline drum. The working party of five men was sent into the storeroom and had accomplished the removal of a number of the tins but on handling those at the back of the shelves the bottoms

of several gave way, spilling two or three quarts and filling the compartment with fumes. Within a period of approximately five minutes, two members of the working party collapsed due to becoming anesthetized. The remaining three men attempted to rescue their comrades when they in turn were overcome by the fumes—all five men being unconscious. The storekeeper in charge, noting that the work of removing the tins had ceased, began to investigate and, upon realizing the condition, summoned help. The men were removed from the compartment with considerable difficulty and taken to the sick bay where they were seen immediately by a medical officer. All five men presented typical signs of moderately deep anesthesia, and all were revived within a few minutes upon access to fresh air. Three of the men felt normal within an hour, the remaining two were somewhat nauseated for several hours, were weak and had a tendency to sleep. The pulse and respiration showed practically no variation from the normal. The urine presented no changes from normal. All men were given cathartics and felt normal the following morning and desired to return to duty; which they were allowed to do.

Carbon tetrachloride has come into toxicological importance in the past few years because of its extended employment in various fields. It is a halogen substitution product of a hydrocarbon, discovered by Regnault in 1839, and is made by passing the vapor of carbon disulphide over carbon heated in an electric furnace or by the chlorination of chloroform, iodine being employed as a catalytic agent. It is a volatile liquid, neither inflammable nor explosive, having a specific gravity of 1.6084 at 9.5° F., and chemical formula  $CCl_4$ . It has a pungent, sickening, sweetish odor, similar to chloroform.

Medicinally carbon tetrachloride is a powerful narcotic surpassing chloroform in the vigor of its action but due to the fact that it is depressant to the circulation it is not available as a surgical anesthetic. In 1922 it was brought forward as a remedy for hookworms and since then has been used by some as a vermifuge for other intestinal worms. For this purpose, however, it must be used with all possible precautions for it appears that there is no specific antidote when poisoned by it. Fatty substances or alcohol increase its absorption and therefore the poisonous effects of the drug. The fatality rate for the average dose of 3 cc. (average dose now recommended is 2.5 cc.) has been stated as 1 death in 50,000 persons, although the fatalities were said to have occurred in alcoholic addicts or feeble individuals.

The use of carbon tetrachloride as a fire extinguisher under the name of "Pyrene" is well known and as a fire extinguisher it is carried in stock and used in considerable quantities by all naval activities. However, it is a potential health hazard when used to

extinguish fires in limited spaces due to the fact that it may cause serious poisoning. In the presence of heat carbon tetrachloride may form phosgene ( $\text{COCl}_2$ ) and hydrochloric acid gas, and there is further danger from the carbon dioxide formed and the evaporation of undecomposed carbon tetrachloride.

In addition to its use as a fire extinguisher it is used extensively in industry as a rubber solvent, as an ingredient in certain types of paint, as a solvent for fats, and as a solvent for alkaloids in assay work and manufacturing processes instead of chloroform. It is also sold in no small quantities by drug, hardware, and department stores under the trade name of "Carbena" as a cleaning fluid for removing grease from garments, etc., replacing petroleum benzine to advantage because of its noninflammability; and a mixture of carbon tetrachloride (25 per cent) and ethylene dichloride (75 per cent) is now on the market as a combination cleaning fluid and fumigant. During the World War it was used as a delousing agent, and was found to be quite effective in ridding clothing of body lice. At one time the chemical enjoyed a certain degree of popularity as a cleansing shampoo for the hair, but following several fatalities from its use as such, its sale for this purpose was prohibited in Paris.

The toxicity of carbon tetrachloride by inhalation or ingestion, and the danger of poisoning by the inhalation of gasses formed when it comes in contact with heat, is apparent. The incident reported above as having occurred on board the U. S. S. *Lexington* clearly emphasizes the danger of handling the chemical in confined or poorly ventilated spaces or compartments, and in order to avoid possible fatalities, storekeepers and others charged with the custody and handling of this chemical should be cautioned regarding the danger involved when fumes may be anticipated or are evident.

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#### TWO UNUSUAL GROUP INSTANCES OF ACUTE GASTROENTERITIS

##### REPORT OF MASS ILLNESS FROM INGESTED WATER ON U. S. S. *VESTAL*

By C. W. BRUNSON, Lieutenant Commander, Medical Corps, United States Navy

Beginning at about 4 p. m. April 23, 1931, and ending at about 9 p. m. April 24, 1931, approximately 105 members of the crew were taken ill with gastrointestinal symptoms. (Complement, 468.)

In the great majority of these cases the complaints were abdominal cramps and diarrhea. Only a small minority complained of nausea or vomiting and only 14 had an elevation of temperature, these latter ranging from  $99^{\circ}$  to  $100.6^{\circ}$ . Blood pressures were normal in the 60 cases taken; urine examinations made in 20 cases were normal.

There was no blood passed by stool and only a small amount of mucus in some stools.

Abdominal examinations made in all cases failed to show any rigidity, distention, or tenderness. Three specimens of feces were examined by the laboratory at the naval dispensary, Guantanamo Bay, Cuba, with negative reports.

All cases were given a purge, followed by a course of bismuth subnitrate and sodium bicarbonate, with the result that all but 16 were able to continue duty the following day. Of the 16 that remained on the sick list, only 1 was at all serious, and this patient had been in a poor physical condition. During the next five days several patients had a return of symptoms requiring additional treatment.

On April 24, 1931, an effort was made to determine the cause of the outbreak, it being thought at first that it was food poisoning; but, as the list of sick included members of several messes, none of which had menus in common, a study of the menus for the previous six meals was made. Nothing of a suspicious nature was found. None of the food that had been served during these meals remained to be examined. Since then, these menus have been repeated without ill effect. This fact, together with negative reports on fecal examinations, seemed to point to some cause other than food poisoning.

At 9 a. m., about seven hours before the beginning of the outbreak, the gravity tank supplying water for the scuttle butt was filled from a reserve feed bottom. This had never been done before. It was necessitated on this occasion by a failure in the regular distilled-water supply from the ship's tanks, due to a breakdown of the evaporating plant. It was established that water from one or more boilers had previously been run into this tank. A specimen was sent to the laboratory at the naval dispensary, Guantanamo Bay, Cuba, and a report received later was negative for bacteria, but a chemical or mineral examination could not be made. It was also learned that an officer from another ship, who had been aboard the U. S. S. *Vestal* between the hours of 9 a. m. and noon on the 23d and had drunk from the crew's scuttle butt, was taken ill that night with symptoms similar to those of our patients.

In view of the following findings, it was decided that we were not dealing with an outbreak of food poisoning, but with an enteritis, which was probably caused by some chemical or mineral content of the water:

(a) Relatively mild symptoms, with practically no vomiting or fever.

(b) Several messes involved.

- (c) The lack of suspicious food served in the six previous meals.
  - (d) The repeating of these menus without a recurrence of symptoms.
  - (e) The new water supply.
  - (f) The one officer from another ship who had drunk Vestal water and become ill.
  - (g) The negative reports on specimens of feces and urine.
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**REPORT OF A MILD EPIDEMIC OF "FOOD POISONING" BY ICE AT THE NAVAL AIR STATION, ANACOSTIA, D. C., AND THE MARINE BARRACKS, WASHINGTON, D. C.**

By A. T. SCHWARTZ, Chief Pharmacist, United States Navy

A mild epidemic of food poisoning due to contaminated ice broke out simultaneously at both the naval air station, Anacostia, D. C., and the marine barracks, Washington, D. C. At the marine barracks the occurrence was somewhat more severe, involving 15 enlisted men and the wives of three officers. There were only eight admissions for the condition at the naval air station.

On Monday, May 12, five men reported at the sick bay of the marine barracks, complaining of diarrhea, nausea, some vomiting, and a variable amount of pain in the abdomen. The following day four more men reported with the same symptoms and all admitted that discomfort began Sunday night or Monday morning. Wednesday three more men were admitted with similar symptoms and giving the same onset. The last evidence of the epidemic was Thursday, May 15, when three men were admitted.

The occurrence at the naval air station began more suddenly, the total number reporting for treatment numbering about 50. Only eight were sufficiently sick to warrant admission to the sick list. The epidemic was of short duration, the symptoms clearing up in three days, May 12-14, inclusive.

Immediately upon the appearance of the initial symptoms, milk sold at the canteen, tap water, and samples of melted ice were sent to the Naval Medical School for examination. The bacterial count of the milk was 35,000 per cubic centimeter, the tap water was bacteriologically negative, while the melted ice demonstrated the presence of colon bacillus. All other articles of food were eliminated.

The fact that all cases at both stations were similar in symptoms, no case being particularly severe though most of them were incapacitated for two or three days, and that the symptoms appeared at the same time at both places points directly to the ice as the causative

factor, since it was the only food material use in common by the many persons affected.

In tracing the outbreak to the ice, it was learned that that used at both stations came from the plant at the Washington Navy Yard. City water is used by the yard in the manufacture of its ice and the ice is stowed only a short time before issue. It was further learned that the wooden covers to the freezing bath were washed down outside of the plant on the Friday preceding the outbreak. In this process boiler compound, which contains about 2 per cent of tannic acid, was used to cleanse and whiten the wooden blocks. Investigation of the personnel revealed the fact that a negro employed in the ice plant had had an attack of diarrhea similar to that of this epidemic between May 5 and May 8, during which period he did not stop working. He admitted that a number of people in his neighborhood were sick with the same symptoms. Other employees at the ice plant were questioned, but none admitted being sick.

It would appear that only a few of the ice blocks were contaminated and these delivered to the two activities involved. Other naval units also received ice from the plant but were not affected. The water must have been contaminated before freezing and the organisms fairly well distributed through each block infected as otherwise the incidence of cases would probably have been less widespread. Forty-eight hours are required for complete freezing. The incubation period of infections with the *B. enteritidis* group is from one to four days. Contamination of water on May 5, freezing completed by the 7th, delivery on the 8th or 9th and consumption on the 9th, 10th, and 11th of the month, is a sequence of events that conforms to the circumstances under consideration. Since considerable ice water and iced tea were used at each station on Sunday, May 11, it is probable that infection occurred on that day.

The possibility of poisoning from the boiler compound is discounted, as the dilution was very great. No bacteriological examinations of the stools were made at either station.

The lesson to be learned from this epidemic is the scrupulous care with which ice manufacture must be conducted. In this case the water to be frozen appears to have become contaminated by a workman who was suffering with diarrhea. At all naval activities where ice is manufactured full instructions as to sanitary requirements should be posted on the bulletin board and the medical officer should make frequent inspections of the plant and examinations of the personnel in order to reduce to a minimum the possibility of infection from human sources.

**HEALTH OF THE NAVY**

Based on statistical returns for diseases and injuries occurring in April, May, and June, 1931, the general admission rate was 497 per 1,000 per annum. The corresponding rate for the first quarter was 592 per 1,000. The median rate for the second quarter, as indicated by the experience of the past five years, is 502.

The admission rate from disease was 443 per 1,000 per annum, as compared with 457, the 5-year median for the corresponding three months. The admission rate from accidental injuries was 53 per 1,000 per annum. The median rate for the corresponding quarter of the previous five years is 51.

Although there were outbreaks of catarrhal fever and influenza during the first quarter of the year, common acute respiratory diseases in general did not exceed expectancy for the months of April, May, and June. A total of 942 cases of these diseases was reported by shore stations in the United States during this quarter, of which 390 were notified in April, 318 in May, and 234 in June. As usual, catarrhal fever predominated.

The United States naval training station, San Diego, Calif., reported 213 cases of catarrhal fever, which was 32 per cent of all cases notified by shore stations in the United States. The other three naval training stations were remarkably free from this disease.

An outbreak of German measles which started at the United States naval training station, Hampton Roads, Va., in March continued through the second quarter of the year. The incidence of the disease was as follows: March 13 cases; April, 48; May, 8; and June, 4.

Ten cases of measles—5 in April; 3 in May; and 2 in June—were also notified by this station.

Sixteen cases of German measles were reported by the United States naval training station, San Diego, Calif., in April.

Three cases of scarlet fever were notified by the United States naval training station, Hampton Roads, Va., in May; 1 by the receiving station, Philadelphia, Pa., in April; and 1 by the navy yard, New York, in May.

A fatal case of cerebrospinal fever was reported by the United States naval hospital, New York, N. Y. The patient was received from the district headquarters, New York, April 10, with a history of two sick days. Death occurred the following day. Another case of cerebrospinal fever was notified by the United States naval training station, Great Lakes, Ill., in April.

The admission rate, all causes, for forces afloat was 444 per 1,000 per annum for the quarter, as compared with 423, the corresponding median rate for the preceding five years.

There were 603 cases of catarrhal fever reported from all ships during the quarter. These cases were distributed among a large number of ships and in no instance did an outbreak occur.

Influenza continued prevalent among forces afloat. There were 128 cases reported. The U. S. S. *Edsall* reported 24 cases; U. S. S. *New York*, 16; U. S. S. *Colorado*, 15; and U. S. S. *Lexington*, 13.

A small outbreak of measles, consisting of 107 cases, occurred among ships of the Battle Fleet. The U. S. S. *Arizona* reported 59 cases; U. S. S. *Pennsylvania*, 17; U. S. S. *Maryland*, 10; and the U. S. S. *Mississippi*, 9.

The U. S. S. *Mississippi* notified one case of scarlet fever in May.

The U. S. S. *Ontario*, the station ship at Tutuila, Samoa, reported 1 case of typhoid fever in April.

TABLE NO. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended June 30, 1931

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	72,282	39,646	18,759	111,928
All causes:				
Number of admissions.....	8,017	5,882	2,633	13,899
Annual rate per 1,000.....	443.65	593.45	561.44	496.71
Disease only:				
Number of admissions.....	7,171	5,236	2,350	12,407
Annual rate per 1,000.....	396.83	528.28	501.09	443.39
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	1,975	2,185	819	4,160
Annual rate per 1,000.....	109.29	220.45	174.64	148.67
Venereal disease:				
Number of admissions.....	2,975	862	628	3,837
Annual rate per 1,000.....	164.63	86.97	133.91	137.12
Injuries:				
Number of admissions.....	838	644	283	1,482
Annual rate per 1,000.....	46.37	64.98	60.34	52.96
Poisoning:				
Number of admissions.....	8	2	0	10
Annual rate per 1,000.....	0.44	0.20	0.00	0.36

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended June 30, 1931

		Navy			Marine Corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	Men		
Average strength.....		8,866	1,853	81,919	1,185	17,574	531	111,928
CAUSE—DISEASE								
Primary	Secondary or contributory							
Abscess:								
Brain.....	Abscess, lung.....					1		1
Buttock.....	Septicæmia.....					1		1
Gluteal region.....	do.....					1		1
Liver, multiple.....	Abscess, lung.....			1				1
Liver, multiple.....	Peritonitis, local, acute.....					1		1
Anemia, pernicious.....	Yaws.....			1				1
Aortitis.....	Arterial hypertension.....					1		1
Appendicitis, acute.....	Peritonitis, general, acute.....	2		1				3



TABLE No. 2.—Deaths reported, entire Navy, etc.—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	Men		
Average strength.....		8,866	1,853	81,919	1,185	17,574	531	111,928
CAUSE—DISEASE—continued								
Primary	Secondary or contributory							
Carcinoma:								
Stomach.....	Obstruction, intestinal, from external causes.	1						1
Sigmoid.....	None.....			1				1
Cellulitis, forearm.....	Septicæmia.....			1				1
Cerebral hemorrhage.....	None.....	1						1
Cerebrospinal fever.....	do.....			1				1
Dilatation, cardiac, acute.....	Hemorrhage, lungs and brain.			1				1
Dementia, præcox.....	Exhaustion from over-exertion.					1		1
Embolism, cerebral.....	Septicæmia.....			1				1
Endarteritis, coronary arteries.....	Thrombosis, left coronary artery.			1				1
Endocarditis, acute.....	Pneumonia, broncho.....					1		1
Influenza.....	do.....			1				1
Do.....	Pneumonia, lobar.....			1				1
Lukemia, lymphatic.....	None.....			1				1
Measles.....	Pneumonia, broncho.....					1		1
Myocarditis, chronic.....	Arteriosclerosis, general.....			1				1
Do.....	Arterial hypertension.....					1		1
Do.....	Dilatation, cardiac, acute.....	1						1
Do.....	Enlargement, prostate.....			1				1
Nephritis, chronic.....	Poisoning, acute, amiodoxyl benzoate.			1				1
Obstruction, intestinal, from external causes.	Hemorrhage, gastro-intestinal.			1				1
Pneumonia, lobar.....	Pleurisy, suppurative.....			1				1
Do.....	None.....			3				3
Thrombosis, superior mesenteric artery. (traumatism).	Arteriosclerosis, general.....					1		1
Tuberculosis, chronic, pulmonary.	None.....			1				1
Do.....	Myocarditis, acute.....					1		1
Do.....	Tuberculosis, genito-urinary system.			1				1
Tuberculosis, meninges.....	None.....			1				1
Total for diseases.....		5		23	2	9		39
CAUSE—INJURIES AND POISONING								
Asphyxiation (spasm of glottis).	None.....			1				1
Burns, multiple:								
Gasoline.....	do.....			2				2
Material unknown.....	do.....	1						1
Crush, falling rock.....	do.....					1		1
Drowning.....	do.....	1		8		1		10
Fracture:								
Compound skull.....	do.....			4				4
Simple skull.....	Intracranial injury.....			2				2
Do.....	Intracranial hemorrhage.....			1				1
Vertebrae.....	None.....			1				1
Injuries, multiple, extreme.....	do.....	1		9		1		11
Intracranial injury.....	do.....			1		1		2
Do.....	Pneumonia, broncho.....			1				1
Landplane crash: injuries, multiple, extreme.	None.....			1		1		2
Homicides: Wounds, gunshot, head and chest.	do.....					1		1
Suicides:								
Wound, penetrating chest.	do.....					1		1
Wound, lacerated throat.	Malaria.....			1				1

TABLE NO. 2.—Deaths reported, entire Navy, etc.—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....		8,866	1,853	81,919	1,185	17,574	531	111,928
CAUSE—INJURIES AND POISONING—continued								
Primary	Secondary or contributory							
Casualties in action:								
Wounds, thigh.....	Hemorrhage, traumatic, left femoral artery.				1			1
Wounds, multiple, gunshot and machete.	None.....				1	1		2
Total for injuries and poisoning.....		3		32	3	7		45
Grand total.....		8		55	5	16		84
Annual death rate per 1,000:								
All causes.....		3.61		2.69	16.88	3.64		3.00
Disease only.....		2.26		1.12	6.75	2.05		1.39
Drowning.....		.45		.39		.23		.36
Other injuries.....		.90		1.17	10.13	1.36		1.25
Poisoning.....								

## ADMISSIONS FOR INJURIES AND POISONING, SECOND QUARTER, 1931

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the second quarter, 1931, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, April, May, and June, 1931	Admission rate per 100,000 per annum	Admission rate per 100,000, year 1930
INJURIES			
Connected with work or drill.....	704	2,516	2,639
Occurring within command but not associated with work.....	437	1,562	1,914
Incurred on leave or liberty or while absent without leave.....	341	1,219	1,535
All injuries.....	1,482	5,296	6,088
POISONING			
Industrial poisoning.....	6	21	33
Occurring within command but not connected with work.....	0	0	100
Associated with leave, liberty, or absence without leave.....	4	14	26
Poisoning, all forms.....	10	36	159
Total injuries and poisoning.....	1,492	5,332	6,247

*Percentage relationships*

	Occurring within command				Occurring outside command—leave, liberty, or absence without leave	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	April, May, and June, 1931	Year, 1930	April, May, and June, 1931	Year, 1930	April, May, and June, 1931	Year, 1930
Per cent of all injuries.....	47.5	43.4	29.5	31.4	23.0	25.2
Per cent of poisonings.....	68.0	21.0	0	62.9	40.0	16.1
Per cent of total admissions, injury and poisoning titles.....	47.6	42.8	29.3	32.2	23.1	25.0

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from April, May, and June, 1931, reports, are worthy of notice from the standpoint of accident prevention:

*Firearms, careless handling of.*—A marine private was on guard duty. His pistol was loaded but safety catch was not adjusted. In pulling on holster, the pistol "went off" inflicting a gunshot wound of the right thigh. Loss of time, 5 days.

*Hatch-cover hazards.*—While coming down a ladder in balloon well, a seaman, first class, carelessly stepped off thinking the hatch beneath was closed and fell a distance of about 12 feet, causing a simple fracture of right tibia. He was in the hospital 101 days and was eventually invalided from the service.

*Hatchway and ladder hazards.*—Carelessness in leaving a bucket of hot water at the foot of a ladder resulted in burns of the right foot and leg of a seaman who in descending the ladder was unaware of the bucket's presence. He was on the sick list 6 days.

Due to the fact that a rung of a ladder was missing a fireman, third class, fell and sustained a lacerated wound of the right leg for which he was on the sick list 6 days. The case was reported as due to "equipment at fault."

*Careless practice—handling of gasoline.*—A seaman, first class, suffered multiple burns of the face, arms, legs, and body when gasoline ignited through carelessness of others while fueling a power boat. Loss of time, 25 days in hospital.

*Careless practice—broken glass.*—While a seaman, second class, was in the washroom he suffered an incised wound of the right foot when he stepped on a piece of broken glass which some other person had thrown on the floor. Loss of time, 2 days.

*Careless practice—allowing boards with protruding nails to lie about decks.*—A seaman, first class, stepped on a nail protruding from a board left carelessly on deck. A punctured wound of the left foot resulted. Loss of time, 3 days.

*Unsafe practice—food-products machinery (meat grinder).*—While a ship's cook, third class, was feeding onions into a meat grinder, he caught his thumb in the revolving parts and suffered an avulsion of the distal phalanx. He was on the sick list 14 days.

*Unsafe practice—food-products machinery (bread mixer).*—In starting to clean a bread mixer before it had stopped, a seaman, first class, caught his fingers in the moving parts and suffered a lacerated wound of hand which incapacitated him for 17 days.

*Unsafe practice—food products machinery (coffee grinder).*—A pharmacist's mate, third class, sustained a compound fracture of a phalanx of the right hand by inserting his fingers to clean out an electric coffee grinder without waiting for it to stop after shutting off the current. He was on the sick list for a period of 17 days.

*Unsafe practice—lye water.*—In an attempt to recover a spoon a marine private thrust his right hand in a bucket containing lye water. He suffered chemical burns which resulted in the loss of 36 days.

*Dangerous practice—Electricity (handling a live wire).*—A piece of live wire was hanging from the chart house. A marine private, thinking it was "dead," caught hold of it to break it off. An electrical burn of the left hand resulted, and the loss of time was 14 days.

*Dangerous practice—Electricity (switch box).*—While cleaning a switch box a seaman, second class, accidentally passed a file across a switch which had not been thrown open according to instructions. This caused a flash that burned both eyes. Loss of time, 1 day.

Without pulling main switch as directed by general safety rules, an electrician's mate proceeded to work around a switch box with a screw driver. The metal end of the tool came in contact with the live switch blade, and an electrical burn of the hand resulted with a loss of time of 5 days. Within a week a similar accident happened to a man of the same rating on the same ship, but the loss of time in the second case was 2 days.

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#### STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

*Cumulative data*

	Number	Per cent of recruits received	Per cent of recruits reviewed
JAN. 1 TO DEC. 31, 1930			
All naval training stations:			
Recruits received during the period.....	9,222		
Recruits appearing before board of medical survey.....	677	7.34	
Recruits recommended for discharge from the service.....	269	2.92	39.73
APRIL, MAY, AND JUNE, 1931			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	299		
Recruits appearing before board of medical survey.....	11	3.68	
Recruits recommended for discharge from the service.....	11	3.68	100.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	484		
Recruits appearing before board of medical survey.....	20	4.13	
Recruits recommended for discharge from the service.....	20	4.13	100.00
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	600		
Recruits appearing before board of medical survey.....	0	0	
Recruits recommended for discharge from the service.....	0	0	0
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	329		
Recruits appearing before board of medical survey.....	32	9.73	
Recruits recommended for discharge from the service.....	7	2.13	21.88

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations.

*Alopecia areata*.—Enlisted at Chicago, Ill., April 2, 1931. Recruit presented an adult facial appearance, although but 17 years of age. When his hair was cut marked alopecia areata was found to exist and further examination revealed cervical, inguinal and auxiliary adenitis. Kahn test, 4 plus. Surveyed April 14, 1931.

*Conjunctivitis, chronic, granular*.—Enlisted at Detroit, Mich., April 23, 1931. Recruit stated that he had "trachoma" recently. Examination of eyes revealed corneal and conjunctival injection with granulations on palpebral conjunctiva. Surveyed May 1, 1931.

*Perforated nasal septum*.—Enlisted at Chicago, Ill., May 4, 1931. Examination of recruit revealed a large complete perforation of the nasal septum. Surveyed May 11, 1931.

*Dental defects*.—Enlisted at Cleveland, Ohio, April 10, 1931. In this recruit teeth Nos. 2, 15, 30, and 31 were carious and Nos. 19 and 20 were missing. Exodontia was indicated in Nos. 30 and 31. There were very wide edentulous spaces at Nos. 19 and 20, seriously interfering with mastication. There was no serviceable molar occlusion present on the left side. Surveyed April 23, 1931.

Enlisted at Baltimore, Md., April 6, 1931. In this recruit teeth Nos. 2, 5, 6, 7, 8, 10, 12, 13, 15, 18, 19, 21, 25, and 31 were carious and Nos. 1, 3, 4, 9, 14, 16, 29, 30, and 32 were missing. There was absence

of left molar occlusion and very probable loss of molar occlusion on the right side at an early date. Surveyed April 7, 1931.

*Goiter*.—Enlisted at Cleveland, Ohio, April 1, 1931. This recruit had a visibly enlarged and definitely palpable thyroid, more marked on the right side. Surveyed April 6, 1931.

*Valvular heart disease (mitral insufficiency)*.—Enlisted at Springfield, Mass., April 15, 1931. This recruit gave a history of rheumatic fever at the age of 12, stating that he was confined to bed for two months at that time. Physical examination revealed a loud blowing systolic murmur at the apex, transmitted to the axilla and back and increased by exercise. Blood pressure 140/102. Surveyed April 20, 1931.

*Acquired absence of part*.—Enlisted at Cleveland, April 3, 1931. In this recruit the left fifth metacarpal and little finger were missing due to gunshot wound. Surveyed April 7, 1931.

*Hernia*.—Enlisted at Albany, N. Y., April 15, 1931. In this recruit there was bulging at the umbilicus, made more prominent in coughing or when the intraabdominal pressure was otherwise increased. There was a small opening between the recti muscles through which the examining finger could be passed. The recruit was also a poorly developed asthenic type. Surveyed April 20, 1931.

Enlisted at Milwaukee, Wis., May 4, 1931. In this recruit the hernia was of the left inguinal region. It was definitely visible and palpable. Surveyed May 7, 1931.

*Ankylosis*.—Enlisted at Boston, Mass., April 2, 1931. This recruit had a partial ankylosis of the left ankle which had followed a Pott's fracture in 1930. There was limitation of motion in all directions and pain upon exercise and manipulation. Surveyed April 3, 1931.

*Flat foot*.—Enlisted at Cleveland, Ohio, April 3, 1931. In this recruit both feet were definitely and markedly flat. Routine military duties would have aggravated the condition. Surveyed April 6, 1931.





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TRUMAN H. NEWBERRY,  
*Acting Secretary.*

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## PREFACE

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The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, notes, and comments on topics of medical interest, and reviews or notices of the latest medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

*Surgeon General United States Navy.*

## NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

# U. S. NAVAL MEDICAL BULLETIN

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No. 2

## SPECIAL ARTICLES

### **CARBON MONOXIDE AND ITS RELATION TO AIRCRAFT<sup>1</sup>**

By JOEL J. WHITE, Lieutenant Commander, Medical Corps, United States Navy

#### INTRODUCTION

The source of carbon monoxide poisoning which forms the basis of this article is the exhaust gas of the gasoline motor of the airplane and airship and was brought to attention by the death of Capt. Arthur H. Page, United States Marine Corps, at the national air races, Chicago, September 1, 1930, and the subsequent report of the finding of carbon monoxide in his blood shortly after the crash. The reports in the press stated that 0.47 per cent saturation was found. Such a small per cent saturation is almost negligible, as the average person does not begin to show symptoms until at least 10 per cent saturation has been reached. In the case of Captain Page, although as long as two hours elapsed before his blood was tested, hardly more than a 5 per cent saturation could have been present, for carbon monoxide is given off very slowly. Notwithstanding the small per cent of saturation of the blood with carbon monoxide in this case and the opinion that this gas was not a direct factor of the crash, the reported finding was of extreme interest and invaluable in bringing attention to the possible hazard of carbon monoxide in relation to aircraft.

The literature mentions the occurrence of the carbon monoxide hazard from many and varied sources, but even in the comprehensive list given by Kober and Hayhurst (1), which contains 24 possible sources of the poisoning, the airplane is not listed.

#### CARBON MONOXIDE

Carbon monoxide is a colorless, tasteless, neutral, almost odorless gas, slightly lighter than air with a specific gravity of 0.967, and

<sup>1</sup> From the Department of Aviation Medicine, U. S. Naval Medical School, Washington, D. C.

almost insoluble in water. It is physiologically harmless and inert, except in one respect, and that is it forms a compound with the hemoglobin called carbon monoxide hemoglobin, which nullifies the power of the red blood cells to carry oxygen to the tissues. Hemoglobin has an affinity for carbon monoxide 299 times greater than for oxygen, according to Haldane (2). Carbon monoxide does not form a permanent compound with the blood and the action of carbon monoxide in the body is purely that of asphyxia, and any subsequent degeneration of the tissues is the result of the injury to the brain and other organs by the insufficiency of oxygen supplied to them while the patient was breathing the gas according to Henderson (3).

*Sources.*—Carbon monoxide is a product of incomplete oxidation of carbonaceous matter. While found only rarely in nature, being formed in considerable amount during lightning storms (4), as well as being produced from growing kelp (5), it is, nevertheless, present to a more or less extent wherever man lives and works. This toxic gas arises from (a) conflagration of buildings; carbon monoxide is the element in the smoke chiefly responsible for firemen being overcome. (b) Lime, brick, and charcoal kilns. (c) Ordinary stoves, grates, braziers, and especially the open gas logs. (d) Fires and explosions in mines; the carbon monoxide in the after damp being more fatal than the fire or explosions. (e) Gases of detonation of high explosives. It was reported (6) that in the battle of Jutland there were many casualties from carbon monoxide. On one vessel several hundred men were fatally affected by carbon monoxide produced from an explosive. (f) Thompson (7) and Armstrong (8) tell of the hazard of this gas to tobacco smokers. (g) Coal and water gas used for heating and lighting purposes. (h) Exhaust gas from internal-combustion engines, especially those of automobiles, motor boats, and airplanes.

In the laboratory carbon monoxide is produced by heating formic or oxalic acid with sulphuric acid.

By far the greater number of cases of poisoning from carbon monoxide are not due to any one of the above conditions, but by the accidental or suicidal inhalation of illuminating gas, which contains as high as 20 per cent carbon monoxide in coal gas and as much as 40 per cent in water gas. Accidents may arise from faulty fittings or valves, from use of flexible hose, etc.

This gas, which causes more deaths than the total of all other gases, acts only by cutting off the supply of oxygen and all symptoms and pathological changes produced are caused by oxygen deprivation.

*Physiological action.*—Not only does the hemoglobin combine with carbon monoxide which is present, in preference to oxygen, but according to Haldane (2), the disassociation between the remaining

oxygen and hemoglobin seems to be changed. Oxygen is given up less readily to the tissues, further increasing the anoxemia. That tissue requiring the greatest amount of oxygen is affected in the greatest degree. The nervous system, the most highly specialized tissue in the body, can withstand anoxemia less than any other tissue. It has been demonstrated that the higher centers of the brain can not be resuscitated if deprived of oxygen for more than eight minutes. Haldane (9) has shown that animals without hemoglobin can live in an atmosphere of 80 per cent carbon monoxide. Air containing 0.02 per cent carbon monoxide causes slight symptoms in two hours and 20 per cent saturation in three and one-half to four hours; 0.03 per cent causes 30 per cent saturation in four hours according to Sayers, Yant, Levy, and Fulton (10). Haldane (11) considers 0.05 per cent is the beginning of toxicity and that 0.2 per cent is very dangerous to man. 0.05 per cent concentration in the air will produce 40 per cent saturation if breathed for four to five hours. Saturation of 80 per cent is fatal at once and 60 per cent saturation has caused death. Breathing a concentration of 0.2 for four or five hours, or 0.4 per cent for one hour will probably cause death (12). Sayers (13) states that 0.01 per cent is the maximum safe concentration for long exposures and Grünewald (14) is of the opinion that 0.03 per cent is dangerous for man.

Haggard and Henderson (15) have given a rule for computing the toxicity as follows: The time of exposure in hours is multiplied by the concentration as in parts per 10,000 in the air. If the product equals 3, or less, there is no appreciable effect; if 6, there is slight malaise; at 9, most individuals suffer headache and nausea. If the product is 15, it is dangerous for any but the briefest exposure. Henderson and his coworkers (16), in their work on the ventilation of the Holland vehicular tunnel, placed a maximum limit of 0.04 per cent of carbon monoxide. The time limit in this case being about 30 minutes. Sayers, Meriwether, and Yant (17) point out that physical exercise and deep breathing produce more rapid saturation with a given concentration. Atmospheric conditions play some part in the effects of carbon monoxide, as there is more rapid diffusion of the gas on a clear windy day. On damp, foggy days the atmosphere seems to act as a blanket, preventing rapid diffusion of the gas. These same authors (17) have demonstrated that when the temperature and humidity are high the combination of carbon monoxide and hemoglobin takes place with greater rapidity. Haldane (18) is of the opinion that carbon monoxide is a tissue poison which destroys a catalyst of oxidation resident in the tissue cells, based on the experiment that rats living on oxygen dissolved in the blood in the presence of sufficient carbon monoxide to combine

with almost all their hemoglobin are killed by the addition of more carbon monoxide.

As the amount of absorption of carbon monoxide is proportioned to the volume of inspired air, it follows that the time for saturation of the hemoglobin with carbon monoxide will decrease as the concentration of the gas rises, so that a concentration of 0.1 per cent for example, would require several hours' exposure before a fatal saturation was reached, while a concentration of 1 per cent would prove fatal in a few minutes. Further, the state of activity of the subject has a great influence on the rate of possible absorption of the gas. Thus, a person doing moderate exercise breathes approximately twice as much air as one at rest and will, as a result, absorb correspondingly more carbon monoxide.

Sayers and Yant (19) state that a long exposure to a low concentration of carbon monoxide will probably produce more serious effects than will a short exposure to a high concentration, assuming that the degree of saturation of the hemoglobin with carbon monoxide is the same in each case, simply because the anoxemia has continued longer in the former instance. Henderson (3) states that the red cells in which the hemoglobin has combined with carbon monoxide and then has been freed from this combination by oxygen inhalation are not at all injured by this process, but are able to again take up their normal oxygen-carrying functions. The after effects of the gas are due to secondary effects brought on by anoxemia.

*Symptoms.*—The symptoms of carbon monoxide poisoning will depend, of course, upon the concentration of the gas and the degree of saturation. Headache, malaise, vomiting, palpitation, dizziness, dimness of vision, loss of muscular power, convulsions, coma, and death usually occur in the order mentioned. If the concentration is very high, death may occur within a very few minutes, even though the conversion of the oxyhemoglobin into carboxy-hemoglobin may be far from complete.

It was noted by the British (20) during the World War that individual susceptibility played a very important part in the poisoning of the soldiers by carbon monoxide. Experience shows that some men could work in an atmosphere that would quickly overcome others who were more susceptible to the effects of carbon monoxide after saturation—for, of course, every one exposed to the same concentration of the gas under the same conditions of temperature, etc., will absorb the same amount. The men less susceptible to the effect of carbon monoxide, when overcome, seldom suffered from the distressing after effects and recovered promptly, whereas the more susceptible men would often develop complications, as heart trouble. It was also found that young men were more susceptible than men over 40, also that men addicted to alcohol were very susceptible



to carbon monoxide. According to Sayers (18) no race or nationality is immune or has a special tolerance for carbon monoxide, and that both sexes are about equally susceptible.

Not infrequently pneumonia follows carbon monoxide exposure and it is a quite fatal type (20), reported by the British during the World War. Pernicious anemia has been reported by Koren (21). Impairment of the myocardium and even cardiac infarction has occurred. Klebs (22) reports the frequency of severe and agonizing pain in the region of the heart.

The most tragic sequelæ, however, occur in the central nervous system. Amblyopia and even complete blindness occurs not infrequently. Some cases regain their sight, some regain it in part. Choreiform movements are common and convulsions frequent. The earliest and most constant ocular sign of carbon monoxide intoxication is congestion of the retinal veins and hyperemia of the optic disk. Murray (23) reports a case of impaired vision in each eye of about two weeks' duration. On the day previous to the onset of the blurred vision the patient had been exposed to the exhaust gas of a gasoline motor for two hours while working in his garage and gave a history of similar exposures on several previous occasions. The onset of the blurred vision was accompanied by the appearance of a yellow spot in the field of vision of each eye. He had an occasional diplopia, some nausea, vomiting, and headache. Examination of the eyes showed injection of the bulbar conjunctivæ, inequality of pupils, blurred disk margins, and engorged retinal veins. Visual fields showed contraction, with sector defects for red and blue; no scotoma was present and no enlargement of the blind spot. He was unable to distinguish green colors. Ophthalmoscopic examination 15 months after onset of the eye involvement showed extensive chorio-retinal lesions throughout the fundus and opacities in the vitreous. Vision in the right eye equaled 10/200, in the left eye 2/200. Wilmer (24) reports two cases of permanent visual defects following exposures to carbon monoxide. Shumway (25) and Abt and Witt (26) report cases of blindness due to exposure to carbon monoxide.

That such diverse and far-reaching sequelæ could be due to a single agent is almost unbelievable, but nevertheless such is the case. The most common symptom, headache, is apparently due to a rise of the intracranial pressure. Weimann (27) has called attention to the frequent severe hyperemia of the entire brain and its membranes. The rise of pressure is thought to be due to a congestion accompanying a rise in arterial pressure during the stage of asphyxia, and later by a cerebral edema.

When the anoxemia progresses further, destruction of nervous elements takes place. Punctiform hemorrhages abound in the leptomeninges and on the internal segments of the lenticular nucleus and

is regarded by some as pathognomonic of carbon monoxide poisoning, as shown by Ruge (28) and Kolisko (29).

According to one report (29) two cases dying on the seventeenth and twenty-fourth day in which was noted softening, or "cellular necrobiosis," which was widespread through almost the entire cortex, being located in the deeper layers of the gray matter, and in the infragranular area. In these softened areas was also noted considerable deposition of calcium in the blood-vessel walls.

Psychomotor disturbances consisting of compulsory primitive movements in which the patients snatch, grope, point, and tear at all objects at hand are reported by Pineas (30). Kleist's catalepsy was also observed, as well as increased vascular excitability.

Why these symptoms take place is not definitely known. Claude (31) considers that these symptoms are due to anoxemia and anemia induced by certain anatomic peculiarities of the blood vessels supplying the central nervous system. Some authorities consider emboli, or thrombi as the etiologic factor. It was thought that there may be degrees of vulnerability to anoxemia in the different parts of the brain.

Percentages of blood saturation and symptoms as given by Sayers and Yant (19) are as follows:

- 0-10—No symptoms.
- 10-20—Tightness across forehead, possibly slight headache, dilatation of cutaneous blood vessels.
- 20-30—Headache, throbbing in temples.
- 30-40—Severe headache, weakness, dizziness, dimness of vision, nausea, vomiting, and collapse.
- 40-50—Same as previous, with increased pulse and respiration and more possibility of collapse.
- 50-60—Syncope, increased respiration and pulse, coma with intermittent convulsions, Cheyne-Stokes respiration.
- 60-70—Coma with intermittent convulsions, depressed heart action and respiration, possibly death.
- 70-80—Weak pulse and slowed respiration, respiratory failure and death.

*Treatment.*—Prevention is the best method of combating the hazard of carbon monoxide poisoning. Its onset is so insidious that by the time the legs give way the victim is unable to assist himself and usually can not even call for help. Persons exposed to carbon monoxide as a rule feel better than normal and can not understand their muscular weakness and inability to perform routine tasks. Automobiles should never be warmed up in a small confined area. Frequent tests should be made of the air in garages, in motor boats, busy street intersections, battleships, and in airplanes and all aircraft having internal-combustion engines.

The effective steps in the treatment of carbon monoxide poisoning are given by Sayers (13) as follows:

1. The patient should be removed to the fresh air as soon as possible.

2. If breathing has stopped, is weak and intermittent, or present in but occasional gasps, artificial respiration by the Schafer method should be given persistently until normal breathing is resumed, or until after the heart has stopped.

3. Pure oxygen, or a mixture of 5 per cent carbon dioxide in oxygen should be administered, using an inhaler, beginning as soon as possible and continuing for at least 20 minutes in mild cases and as long as three hours if necessary in severe cases if the patient does not regain consciousness. While the carbon dioxide-oxygen mixture will remove the carbon monoxide from the blood a little faster than the breathing of pure oxygen, the time of recovery and the after condition of the patient are practically the same.

The administration of oxygen or mixture of carbon dioxide and oxygen, when given immediately, will greatly lessen the number and severity of the symptoms of carbon monoxide poisoning and will decrease the possibility of serious after effects.

4. Circulation should be aided by rubbing the limbs of the patient and keeping the body warm with blankets and hot water bottles. This aids in tiding the body over a period of low vitality. Other stimulants, such as hypodermics of caffeine, sodium benzoate, camphor in oil, may be given when indicated.

5. The patient should be kept at rest, lying down in order to avoid any strain on the heart. Later he should be treated as a convalescent and given plenty of time to recuperate and rest. Exercise was at one time recommended as a treatment for cases of carbon monoxide poisoning and is still used by many laymen. Exercise causes carbon monoxide to be eliminated from the body much more rapidly than it would be if the patient remained at rest. However, the procedure is hazardous, as the subject quite often loses consciousness, and in some cases death occurs. It would seem that there might be some value in the administration of alkaline solutions as reported by Mikami (32). After effects of carbon monoxide should be treated symptomatically.

#### CARBON MONOXIDE IN RELATION TO AIRCRAFT

As a result of the reported finding of carbon monoxide in the blood of Captain Page, investigation and research in regard to this possible hazard in naval aircraft was undertaken by the Bureau of Medicine and Surgery in September, 1930. Invaluable cooperation was rendered by the Bureau of Aeronautics and the Naval Air

Station, Anacostia, in the furnishing of planes and pilots for the many test flights.

The pyro-tannic acid method was used in testing the blood as well as the air samples. The blood saturation tests were made first, as it was felt that the paramount problem to be decided was whether the pilot was actually absorbing any carbon monoxide. The procedure employed in carrying out the tests was to have the different types of planes fly continuously for four hours, then immediately upon landing take samples (6 to 8 c. c. of blood) from the pilot and other occupants of the plane. In order to test for the presence of the gas in the different cockpits, or other parts of the plane, the writer or other flight surgeons made all test flights except in 1-seated planes. The blood samples were placed under oil in special test tubes containing calcium oxalate and taken to the laboratory at the Naval Medical School. Known standards were prepared by saturating blood with carbon monoxide gas, which represented 100 per cent saturation, then diluting down the scale 95, 90, down to 5 per cent. Controls were also prepared. The blood samples taken from the occupants of the planes were then treated with a solution of tannic and pyrogallic acids. The unknown specimens were then compared with the set of known standards and controls and the amount of carbon monoxide, if any, evaluated (Sayers and Yant (38)). The Van Slyke method was used on two occasions, but found to be impracticable for use in our work due to the time required to prepare and set up the apparatus between each test.

The first series of tests gave positive results for carbon monoxide in the blood in three types of planes—observation, bombing, and amphibian—10 per cent saturation in the observation and bombing planes and 15 per cent in the amphibian. The tests were repeated with the same results. Upon verification of these findings, the engine section of the Bureau of Aeronautics, under Commander C. A. Pownall, United States Navy, took immediate steps to eliminate the carbon monoxide by modification of the exhaust leads of those planes giving positive tests for the gas. In some instances one modification was sufficient, but in other cases several modifications were made before the carbon monoxide was entirely eliminated.

As the work of checking the planes progressed, the Bureau of Medicine and Surgery, in conjunction with C. E. Earle, chemical engineer of the Bureau of Aeronautics, and the Mine Safety Appliances Co., of Pittsburgh, Pa., developed the Carbon Monoxide Indicator, which is based on the principle of catalysis. The instrument consists essentially of a small motor-driven positive-pressure pump; a canister of chemicals (calcium chloride and activated alumina) to remove any moisture from the air being tested; a cell containing the

catalyst (hopcalite); a series of thermocouples in the catalyst cell, the thermocouples in turn being directly connected to the indicating meter. The meter is calibrated in hundredths of per cent carbon monoxide and has a scale range from 0 to 0.15 per cent; a flow meter consisting of a capillary and manometer, in order to maintain an even constant flow of air through the instrument. This is accomplished by having a constant differential on the manometer through adjustment of the volume-control valve.

When it is desired to test for carbon monoxide in an airplane or elsewhere the motor is switched "On," starting the pump which draws the air to be tested into the instrument. By means of a sampling tube the air may be drawn from any desired level. The

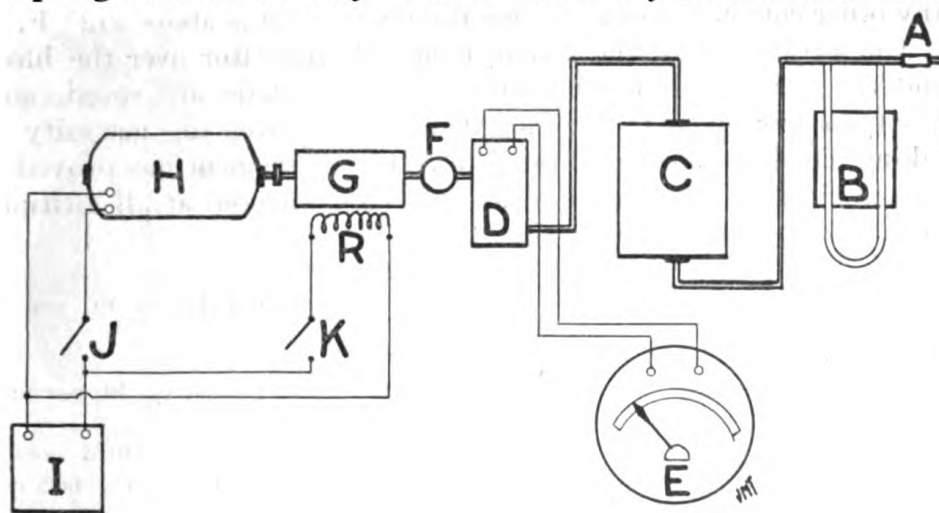


FIG. 1 FLOW SHEET OF CO INDICATOR

Figure 1 gives a diagrammatic flow, of air being tested, through the carbon-monoxide indicator system. A is the air inlet to the instrument. The air may be taken in at A or a sampling tube may be coupled at this point. B is a manometer the legs of which are connected across a capillary tube, thus forming what is ordinarily known as a flow meter. This meter measures the proper rate (liters per minute) of air to be taken into this system. C is a dehydrating cannister containing calcium chloride and soda lime for removing the moisture contained in the air. Water makes the catalyst inactive and therefore must be entirely removed before the air enters the catalyst cell D. The cell contains a series of thermocouples. Around the hot junction of the thermocouples active Hopcalite (catalyst) is packed and around the cold junction inactive Hopcalite is packed for the purpose of equalizing the heat capacity of the two junctions. Furthermore, the cell is symmetrically designed to further equalize the heat capacities in order that temperature changes will not affect its stability. The thermopile is connected to the millivolt meter E, which is calibrated in hundredths per cent carbon monoxide. F is a control valve which can be manipulated so as to maintain the proper rate of flow of air through the instrument. G is a rotary gear pump which draws the air through the instrument. The pump gears are grease sealed. The grease will obviously stiffen at low temperatures and cause the pump to be sluggish. To prevent this condition an electric heating element R is installed in the pump case to reduce the viscosity of the grease prior to starting the pump. In extremely cold weather it may be necessary to keep the heater on. H is a small motor for driving the pump. In the portable instrument of the latest design the motor is operated on a 6-volt system I, which consists of three Edison cells in series. J is the motor switch and K the heater switch.

sample first passes through the flow meter in order to maintain a constant flow. The sample then passes through the canister of drying agent and from the canister it passes into the cell containing the catalyst and then out through the exhaust valve of the pump. In the cell the carbon monoxide is oxidized to carbon dioxide by the catalytic action of the hopcalite. Heat liberated by this oxidation is directly proportional to the amount of carbon monoxide present and is measured by the series of thermocouples connected to the indicating meter.

The hopcalite, or catalyst, is composed of manganese dioxide and cuprous oxide, prepared under certain temperature and pressure conditions, and is selective for carbon monoxide only and will not oxidize any other combustible gas, unless the temperature is above 212° F.

The advantages of the carbon monoxide indicator over the blood and air analysis in testing for carbon monoxide are speed, simplicity, accuracy, and the fact that it eliminates the necessity of taking blood samples from the pilot. The instrument has proved to be practical under all conditions and has been used at all altitudes up to and including 20,000 feet.

#### SUMMARY OF THE TESTS CARRIED OUT IN DIFFERENT TYPES OF PLANES

October 7, 1930:

OL-8 plane.—Pilot 15 per cent absorption and passenger 10 per cent absorption.

T4M plane.—Pilot 10 per cent absorption. Passenger in third cockpit 5 per cent absorption. Passenger in radio compartment 7½ per cent absorption. Passenger in front cockpit negative.

O2U-1 plane.—Pilot and passenger were negative.

F7C-1 plane.—Negative.

F8C-5 plane.—Pilot and passenger negative.

F3B plane.—Negative.

October 16, 1930:

OL-8 plane.—Pilot and passenger showed 5 per cent absorption.

T4M plane.—Pilot 10 per cent absorption. Passenger in third cockpit 10 per cent absorption. Passenger in radio compartment 10 per cent absorption. Passenger in front cockpit negative.

F7C-1 plane.—Negative.

O2U-1 plane.—Pilot and passenger negative.

F8C-5 plane.—Pilot and passenger negative.

October 23, 1930:

NY-1 plane.—Pilot and passenger negative.

October 28, 1930:

O2U-1 plane.—Pilot and passenger negative.

November 11 and 20, 1930:

O2U-1 plane.—Pilot and passenger negative.

OL-8 plane.—Pilot and passenger negative.

December 2, 1930:

RR-4 plane.—Pilot and passenger negative, also air samples from pilot's and passengers's compartment negative.

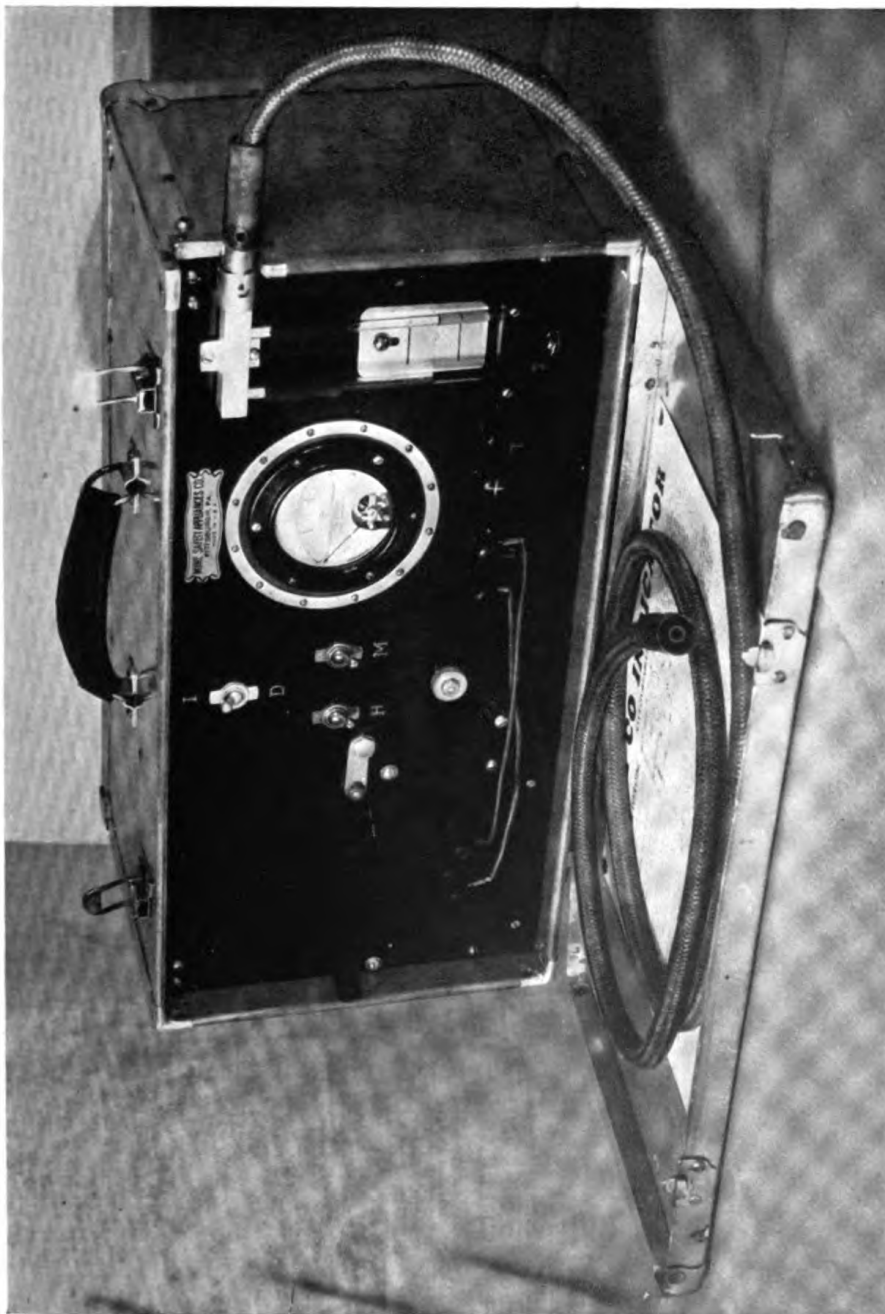


FIGURE 2.—CARBON MONOXIDE INDICATOR. PORTABLE TYPE

160—1



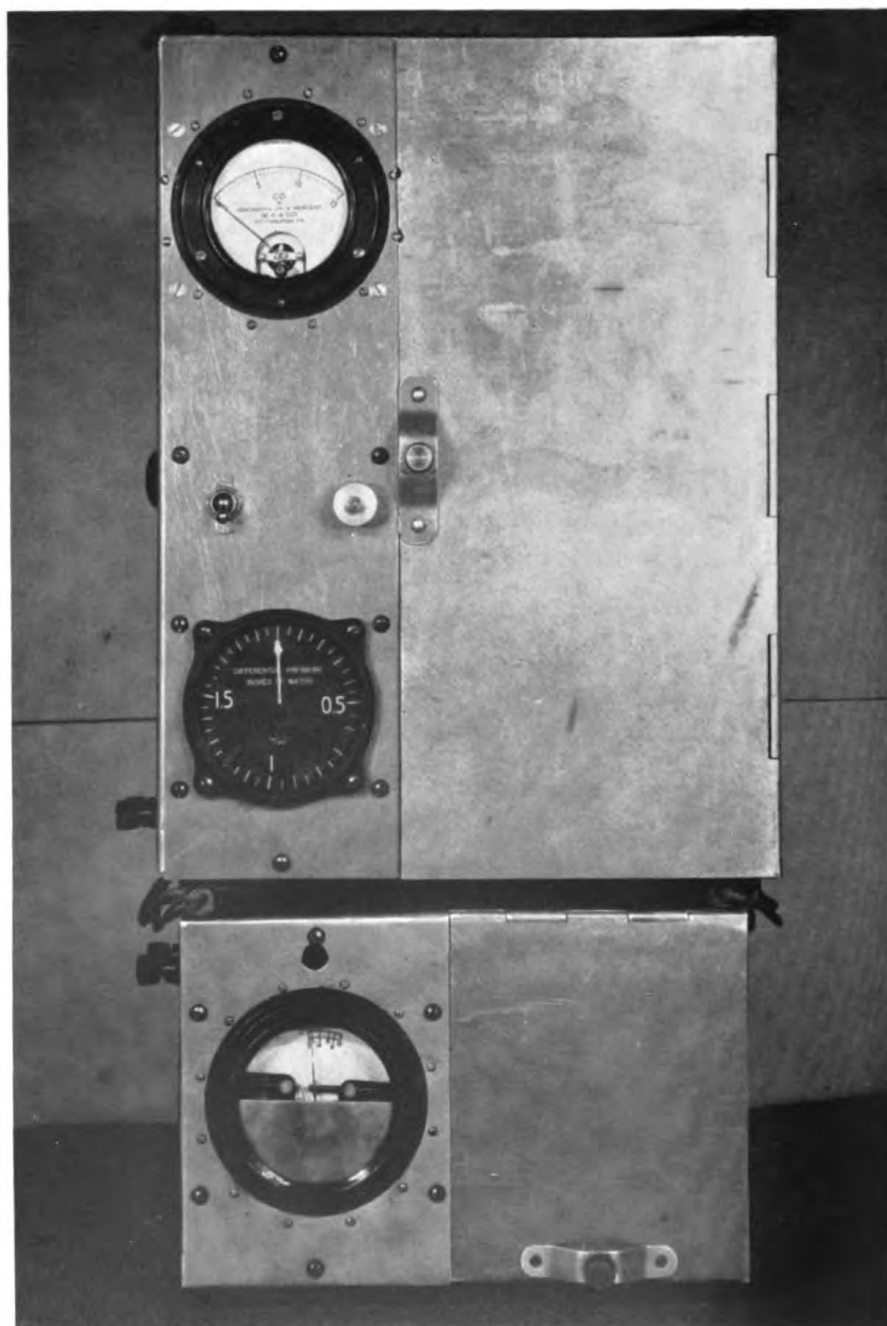


FIGURE 3.—CARBON MONOXIDE INDICATOR. FOR PERMANENT INSTALLATION

160-2



**December 9, 1930:**

OL-8 plane.—Plane equipped with bayonet-type exhaust and T4M equipped with partial manifold on upper cylinders. The pilots and other occupants of both planes gave negative results on blood tests. The air analysis from samples of air taken from cockpit in OL-8 plane showed the presence of carbon monoxide in proportion of approximately 1 part to 20,000 and air analysis of rear cockpit of the T4M plane showed the presence of carbon monoxide approximately 1 part in 10,000, in both cases the carbon monoxide evidently being below the breathing level, as none was absorbed by the occupants of the planes during a flight of 4 hours and 20 minutes.

**December 11, 1930:**

RR-2 plane.—Pilot and passengers negative as well as air samples from the plane.

**December 29, 1930:**

O2U-3 plane.—Pilot and passenger negative.

**January 20, 1931:**

O2U-1 plane.—Pilot and passenger negative.

**January 30, 1931:**

RR-2 plane.—Pilot and passenger negative.

**February 2, 1931:**

JR-2 plane.—Pilot and passenger negative.

**February 26, 1931:**

O2U-1 plane.—Pilot and passenger negative

**March 6, 1931:**

O2C-1 plane.—First test in which the carbon monoxide indicator was used. The indicator showed a concentration of 0.02 per cent carbon monoxide in both front and rear cockpits, also blood analysis of both the pilot and passenger showed the absorption of  $7\frac{1}{2}$  per cent carbon monoxide.

**April 9, 1931:**

O2U-1 plane.—The carbon monoxide indicator gave negative readings in both cockpits.

**May 1, 1931:**

X2Q-2 plane.—Negative—Carbon monoxide indicator used.

**May 6, 1931:**

O2U-1 plane.—Both cockpits negative. Blood tests of passengers negative.

**May 16, 1931:**

O2C-1 plane.—Carbon monoxide indicator gave reading of 0.02 per cent in front cockpit and 0.01 per cent concentration of carbon monoxide in rear cockpit.

**June 1, 1931:**

O2C-2 plane.—Carbon monoxide indicator showed concentration of 0.01 per cent in each cockpit.

**June 12, 1931:**

O2U-3 plane.—Both cockpits negative, with a concentration of 0.02 per cent outside of both cockpits on left side. The carbon monoxide indicator was used.

**June 30, 1931:**

O2U-1 plane.—0.01 per cent in rear cockpit.

**July 21, 1931:**

X-T5M plane.—Negative both cockpits.

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August 4, 1931:

X-F8C-7 plane.—Rear cockpit showed 0.02 per cent concentration of carbon monoxide.

August 25, 1931:

O3U-1 plane.—Front cockpit 0.01 per cent and rear cockpit 0.03 per cent concentration.

September 5, 1931:

O2U-3 plane.—Rear cockpit 0.02 per cent concentration.

September 26, 1931:

X-T5M plane.—Rear cockpit 0.02 per cent concentration and front cockpit 0.01 per cent concentration.

October 16, 1931:

O3U-2 plane.—Front cockpit 0.02 per cent and rear cockpit 0.04 per cent concentration of carbon monoxide.

October 30, 1931:

OL-8 plane.—Front cockpit 0.03 per cent concentration. Rear cockpit 0.03 per cent concentration.

O3U-2 plane.—Front cockpit 0.01 per cent and rear cockpit 0.02 per cent concentration of carbon monoxide.

November 5, 1931:

RS-3 plane.—Cabin type negative.

November 6, 1931:

T4M plane.—All cockpits negative.

O2U-1 plane.—Both cockpits negative.

November 10, 1931:

O2U-1 plane.—Both cockpits negative.

November 19, 1931:

O2U-3 plane.—Negative.

November 20, 1931:

O2U-3 plane.—Negative.

November 23, 1931:

NC-2 plane.—Negative.

November 24, 1931:

O2U-1 plane.—Negative.

December 3, 1931:

RR-4 plane.—Negative.

On the new dirigible, U. S. S. *Akron*, the sleeping quarters of the officers and men, as well as the control car, are to be heated—the first time heating has been attempted in an airship. As the heating is to be accomplished by passing air over the exhaust manifolds of the engines (the two forward engines) the possibility of the leakage of exhaust fumes, including carbon monoxide, into the air as it passes over the manifolds was at once apparent. To take care of this possible hazard, a carbon monoxide indicator has been installed in each of the two engine compartments supplying heat to the ship. By means of a sampling tube connected to the main heating ducts as they leave the engine compartments samples of the heated air will be continuously tested while the heating system is being operated. In case carbon monoxide should leak into the heated air, it will be recorded on the indicating meter. In addition there is being developed for the *Akron*, where continuous testing is necessary, an

automatic alarm system which warns of the presence of this gas by the flashing of a red light in the engine compartment and the sounding of a buzzer in the control car.

By means of blood and air analysis and later by means of the carbon monoxide indicator, every type of naval airplane available at Anacostia has been tested for the presence of carbon monoxide gas, and in all cases where positive results have been obtained modification of the exhaust leads have been made until all traces of the gas have been eliminated. All new planes are tested upon arrival at the air station. As a result of the investigation the specifications now require that all new planes in the future shall be tested at the factory for carbon monoxide and, if present, eliminated before being accepted by the Navy.

#### SUMMARY

1. Carbon monoxide, a product of incomplete combustion, is present in the exhaust gas of all types of airplanes. In some types of planes, depending on type of exhaust leads, fuselage, etc., this gas is carried back to the cockpits of the plane in sufficient concentration to result in as much as 15 per cent saturation of the blood of the pilot and other occupants of the plane.

2. Although the highest saturation of blood obtained during the investigation (15 per cent) is not sufficient to render a person unconscious, or to be a direct cause of a crash, it is known that the absorption of even minute amounts of carbon monoxide is highly undesirable, due to the probable adverse effect on the efficiency of the pilot.

3. The fact that exposure to a low concentration over a long period is more harmful than a brief exposure to a very high concentration, increases the importance of eliminating all traces of carbon monoxide.

4. Comparatively simple and inexpensive modification of the exhaust leads has eliminated carbon monoxide from the area where it is absorbed by the pilot or other occupants of the plane.

#### ACKNOWLEDGMENTS

It is a pleasure to acknowledge the assistance accorded in every part of this study and investigation by Rear Admiral C. E. Riggs, Surgeon General, United States Navy; Capt. C. S. Butler, Medical Corps, United States Navy, Commanding officer of the United States Naval Medical School; Capt. W. H. Bell, Medical Corps, United States Navy, in charge of the Division of Preventive Medicine, Bureau of Medicine and Surgery; Lieut. Commander Paul Richmond, Medical Corps, United States Navy, in charge of the clinical laboratories; Commander C. A. Pownall, United States Navy, in charge of the engine section, Bureau of Aeronautics; the aviators on duty in the Bureau of Aeronautics, who volunteered to make the test flights

and submitted to blood tests in the beginning of the investigation; Commander A. H. Douglas, United States Navy, former commanding officer, naval air station, Anacostia, and the aviators under his command; Mr. C. E. Earle, chemical engineer, Bureau of Aeronautics, particularly in connection with the development of the carbon monoxide indicator; Dr. F. A. Smith, chemist, gas laboratory, United States Bureau of Standards; P. O. Brigham, chief pharmacist's mate, United States Navy; and the Mine Safety Appliances Co., of Pittsburgh.

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#### TRAUMATIC AIR EMBOLISM IN SUBMARINE ESCAPE TRAINING<sup>1</sup>

By B. POLAK, Lieutenant Commander, Medical Corps, United States Navy, and H. ADAMS, Lieutenant Commander, Medical Corps, United States Navy

#### INTRODUCTION

Since training with the submarine escape apparatus, commonly called the Momsen "lung," was instituted, 10 accidents have occurred, 2 of which have been fatal. Three of these cases were reported by MacClatchie (1) and five more by Brown (2). Of the two fatal cases, one commented on by Brown (2), was held to be due to caisson disease (3). The other occurred on May 22, 1931, at San Diego, Calif. In this case the deceased made an escape from a depth of 15 feet in two or three seconds. After appearing on the surface he closed the shut-off valve and reached the ladder to ascend the float,

<sup>1</sup> From the Department of Physiology, Harvard School of Public Health. This study was financed in part by the U. S. Navy and in part by the Miriam Smith Band fund of the Harvard School of Public Health.

but was unable to grasp it and fell backward. He was rescued and taken on board the U. S. S. *Ortolan*, where he was seen by a medical officer. He breathed a few times and expired. Artificial respiration with oxygen administration was resorted to for one hour. Adrenalin was injected, massage and heat applied, but to no avail. An autopsy, performed five hours later, revealed numerous minute hemorrhages throughout both lungs, minute tears of the parietal pleura, and a small subarachnoid hemorrhage over the parietal area of the right cerebral hemisphere. The right ventricle of the heart was definitely dilated.

With one exception the entire group of accidents occurred from depths of less than 30 feet and with short exposures. From this it would appear that caisson disease is not a factor in these cases, as it is generally conceded that decompression is not necessary from a depth of less than 42 feet, with its corresponding pressure.

All of the cases give histories containing certain important common characteristics, namely, excessively rapid ascent under conditions preventing proper equalization of intrapulmonic pressure to the fall in external pressure and an interval after reaching the surface before symptoms occur.

A man wearing the "lung" may make a rapid ascent providing breathing takes place to allow for equalization of the pressure of gases in the respiratory system with that in the apparatus, which in turn is equalized with the pressure of water outside through the flutter valve and by venting air through the mouth around the mouth-piece, thus relieving the pressure in the trachea and lungs. If the breath is held during the ascent, the gas in the respiratory system expands, because it can not escape, and may cause serious damage.

#### EXPERIMENTAL

In considering the pathological physiology of the accidents, it was first thought that the increased intrapulmonic air pressure, inevitably present when one makes a quick ascent with the air passages closed, shut off the pulmonary capillaries and thus placed a load on the right ventricle which caused acute failure. In this direction Chillingworth and Hopkins (4), employing dogs, found that with an increase in the intrapulmonic pressure the systemic arterial blood pressure dropped markedly to a few millimeters above zero, while the venous pressure rose markedly and the carotid pulsations ceased, although the heart continued to beat, indicating a mechanical block of the circulation in the vessels of the lung, due to the occlusion of the pulmonary capillaries. The failure of the carotid pulsations was due to the lack of blood supply to the left ventricle, caused by the pressure exerted directly on the small pulmonary vessels.

These same authors (5), working further, reported that the pulmonary artery pressure equaled that of the systemic blood pressure when there was an excess intrapulmonic pressure of 50 millimeters of mercury. If the intrapulmonic pressure exceeded this, the pulmonary artery pressure often exceeded that of the systemic blood pressure and influenced the coronary circulation unfavorably with possible disaster to the heart.

#### METHODS

Dogs averaging about 18 kg. in weight were used for these experiments. The anæsthetic used was Nembutal, given intraperitoneally, in dosage of 40 mg. per kg. dissolved in 20 c. c. of normal salt solu-

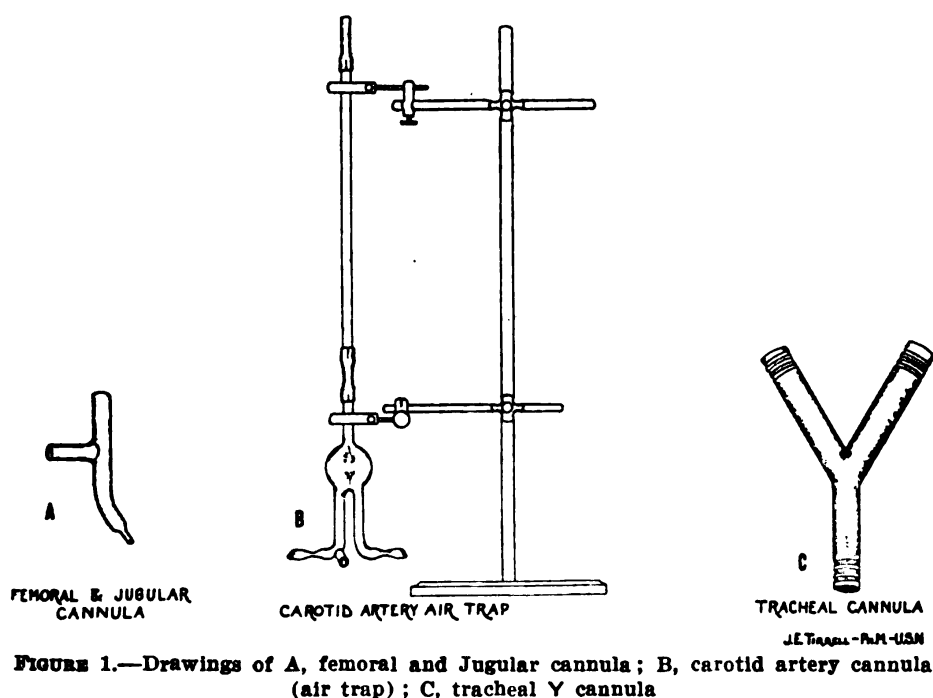


FIGURE 1.—Drawings of A, femoral and Jugular cannula; B, carotid artery cannula (air trap); C, tracheal Y cannula

tion. A tracheotomy was performed and a Y cannula tied in place. (fig. 1c.) One arm of this cannula was connected to a compressed air line (fig. 2), and the degree of pressure was regulated by a lateral exhaust tube with a clamp. This exhaust tube was connected with a 20-liter reservoir which was connected to the air line. The reservoir was used to maintain a steady pressure. A mercury manometer was connected to the air line. A second connection to the air line was made to a recording mercury manometer on a drum. Distention of the lungs was accomplished by stopping the free arm of the Y cannula and the pressure built up and held at the required degree for a given time when it was released by removing the stopper. A femoral cannula (fig. 1a) was inserted in one femoral artery and connected to a recording mercury manometer on the drum. A

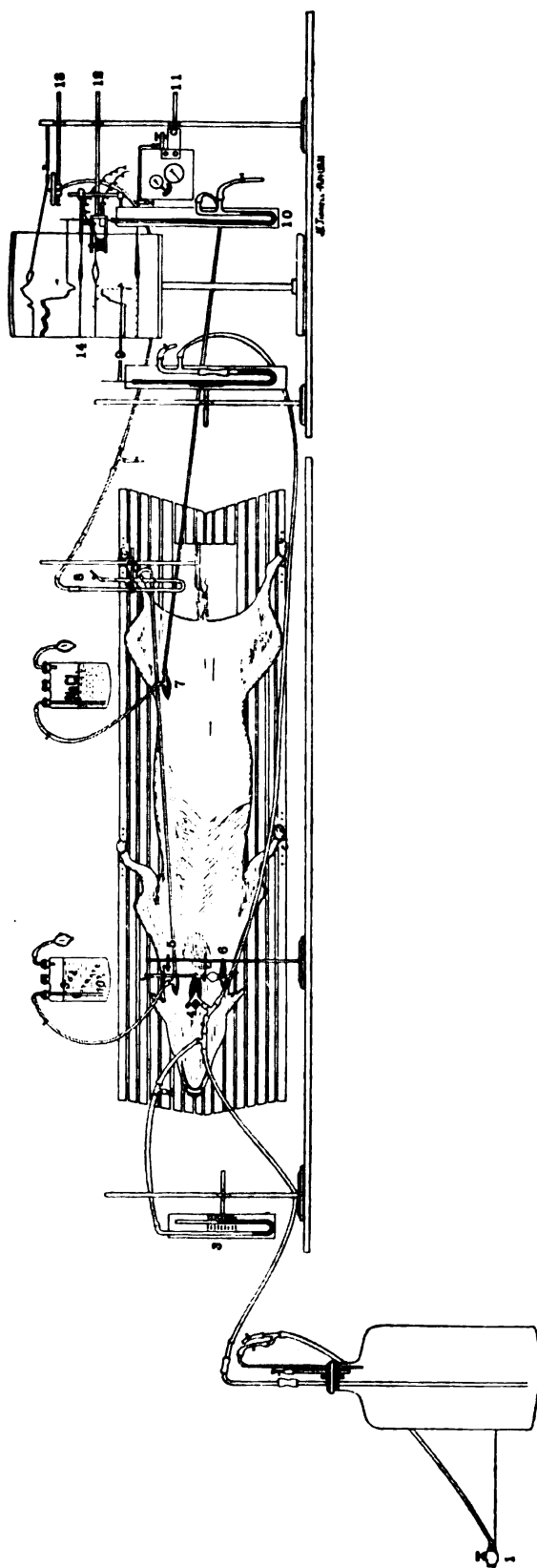


FIGURE 2.—Detailed drawing of apparatus: 1, Compressed air line; 2, compressed air reservoir; 3, air pressure mercury manometer; 4, tracheal cannula; 5, jugular vein cannula and manometer line; 6, cartoid cannula (air trap); 7, femoral artery cannula and manometer line; 8, venous pressure water manometer; 9, air pressure mercury manometer; 10, arterial blood pressure mercury manometer; 11, timer (six-second intervals); 12, signal magnet; 13, venous pressure air tambour; 14, base line for arterial blood pressure



cannula was inserted in the left internal jugular and connected with a water manometer, which in turn was connected to a tambour with a recording needle on the drum.

The various tracings recorded in the following experiments are designated as follows: A, venous blood pressure recorded by water manometer attached to recording tambour; B, femoral blood pressure recorded by mercury manometer; C, zero level for femoral blood pressure; D, record of signal marker; E, zero level of intrapulmonic pressure recorded by mercury manometer; F, time, at intervals of six seconds.

#### FIRST GROUP OF EXPERIMENTS

*To test the hypothesis that a rise in pulmonary blood pressure caused heart failure*

*Experiment 13, October 9, 1931, Figure 3.*—The systemic pressure before lung distention was 156 mm. Hg. The intrapulmonic pressure was raised to 80 mm. Hg and held for 10 seconds. The record shows an intrapulmonic pressure of 100 mm. Hg, but a correction of 20 mm. Hg must be made for the thrust of the needle when the pressure is turned on suddenly. However, the true pressure in the lung was 80 mm. Hg, as is shown by the plateau on the record. On increasing the pressure in the trachea the systemic blood pressure fell immediately to 28 mm. Hg. The venous pressure rose to 120 mm. water. With the release of the intratracheal pressure the systemic blood pressure gradually returned to 128 mm. Hg within one minute. This showed that there was a blocking of the circulation in the lungs, sufficient to cause a marked fall in the systemic blood pressure, and with this there was an instant and corresponding rise in the venous pressure.

This experiment and others of exactly the same type showed that the human accidents which have occurred can not be explained by failure of the right ventricle incident upon high pulmonary pressure. The right ventricle received very little blood during the period of increased intrapulmonary air pressure, owing to the fact that the veins entering the heart are occluded when the pressure is raised. This is shown in the rise of venous pressure. A pump which receives nothing to eject will not build up a disastrous pressure. In the case of the heart, if inflow to the right ventricle was shut off for some minutes, the heart would fail through asphyxia, but in the human accidents seconds only have been involved. It therefore becomes necessary to look for another explanation, and a wholly satisfactory solution was provided by means of a second group of experiments.

## SECOND GROUP OF EXPERIMENTS

*The causation of extensive air embolism through an increase in intrapulmonic air pressure*

In 1931 Joannides (6) reported that when the intrapulmonic pressure is great enough to greatly expand the lungs (60 to 100 mm. Hg) emphysema, pneumothorax, pneumoperitoneum, and air embolism invariably result.

Ewald and Kobert (7), in 1883, stated that an increase of 35 mm. Hg intrapulmonic pressure was sufficient to distend the removed lungs and cause the escape of air through what they called the normal stomata of the alveolar walls into the pulmonary capillaries. In the living animal 50 to 90 mm. Hg was necessary.

The same apparatus was used as in the first experiments, with the addition of a modified Van Allen carotid cannula pictured in Figure 1b. This cannula was inserted in the common carotid artery and was filled with normal salt solution. The cannula acted as a trap if bubbles of air passed into the left ventricle and were expelled into the aorta. During the entire experiment blood circulated steadily through it and air was trapped in the long arm if bubbles came with the carotid flow. In order to prevent coagulation and blockage of blood flowing through the trap the animal was thoroughly heparinized (20 mg. per kg. of body weight intravenously).

*Experiment 16, October 28, 1931, Figure 4.*—The systemic blood-pressure reading was 144 mm. Hg before the intrapulmonic pressure was increased. The intrapulmonic pressure was then raised to 60 mm. Hg and there immediately resulted a typical fall in the systemic blood pressure with a rise in the venous pressure. The intrapulmonic pressure was maintained for 10 seconds and suddenly released. Upon this release of the intrapulmonic pressure the arterial pressure began to rise and returned to normal in about three minutes. No bubbles appeared in the carotid trap. It was assumed that little or no air embolism had occurred and the animal was obviously in excellent condition. The intrapulmonic pressure was then increased to 80 mm. Hg. The typical fall in systemic blood pressure and increase in the venous pressure occurred. The pressure was maintained 10 seconds and suddenly released. Shortly after the release of pressure numerous bubbles appeared in the carotid trap. The systemic blood pressure rose to 90 mm. Hg in four minutes. The intrapulmonic pressure was then raised to 100 mm. Hg, held for 10 seconds, and suddenly released. Shortly after this numerous bubbles appeared in the carotid trap and the animal failed to breathe, but the heart continued to beat for about two minutes.

Autopsy upon this animal revealed an extensive interstitial emphysema throughout the mediastinum, extending from the neck to the diaphragm, but more evident about the posterior surfaces of the

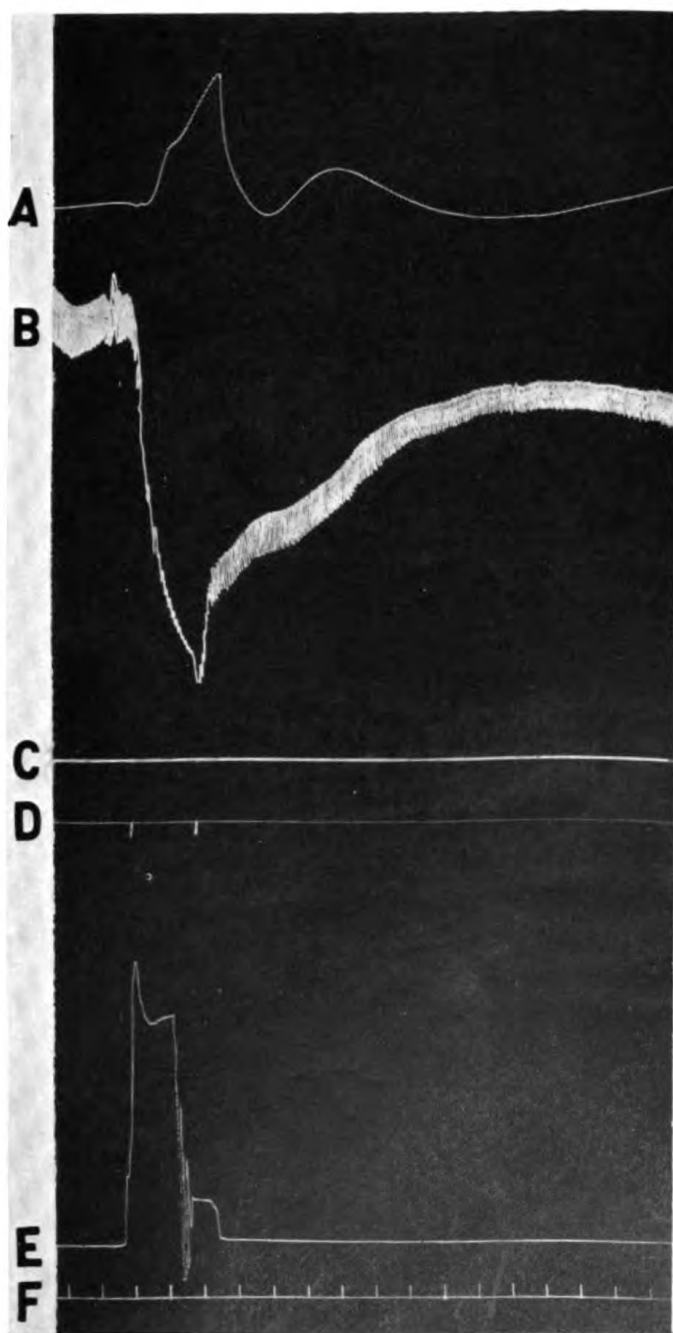


FIGURE 3.—EXPERIMENT NO. 13 OF OCTOBER 9, 1931  
DOG 20, 6 KG. NEMBUTAL

The letters in this and the succeeding kymographic tracings indicate the following: A, Venous blood pressure recorded by water manometer attached to recording tambour; B, femoral blood pressure recorded by mercury manometer; C, zero level for femoral blood pressure; D, record of signal marker; E, zero level of intrapulmonic pressure recorded by mercury manometer; F, time, at intervals of six seconds. Record shows effect of 80 mm. Hg increased intrapulmonic pressure on the femoral and venous blood pressures.

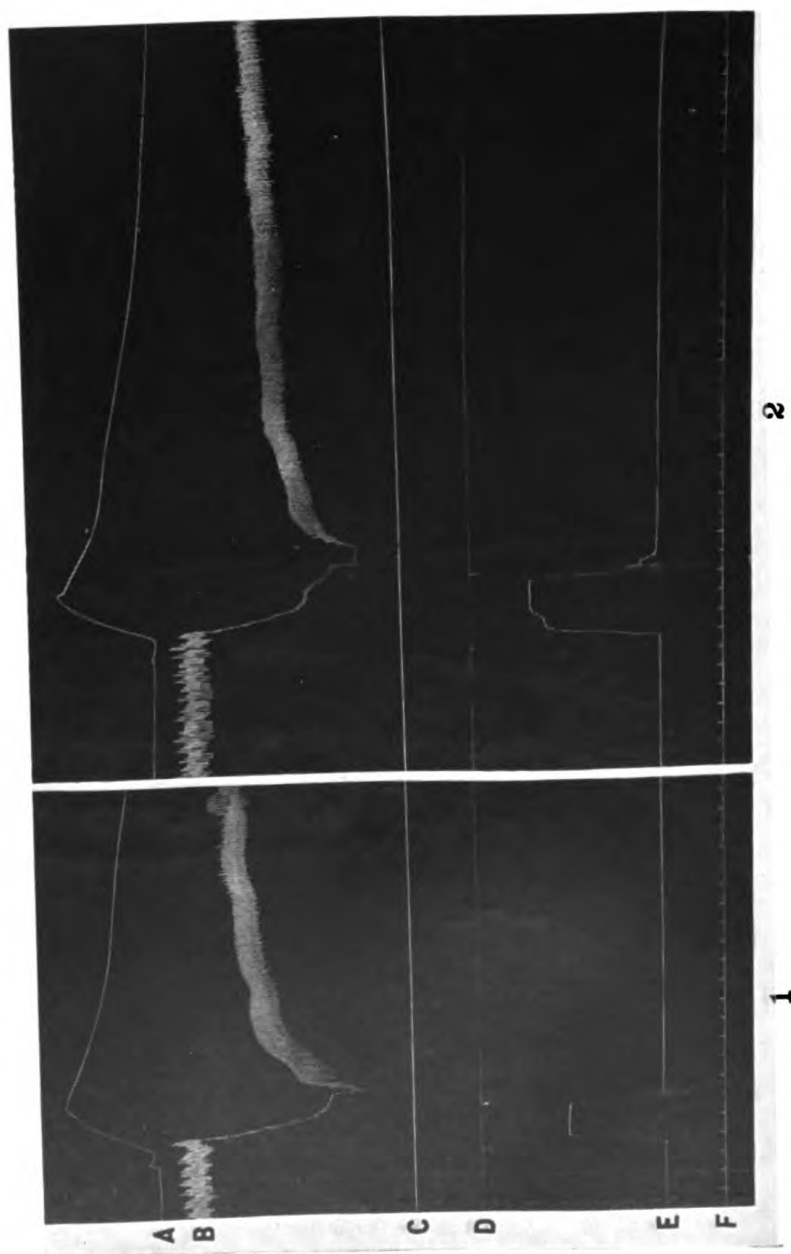


FIGURE 4.—EXPERIMENT NO. 16 OF OCTOBER 28, 1931. DOG 14, 3 KG. NEMBUTAL  
 Carotid trap tied into right common carotid. Dog heparinized by 286 mg. heparin in normal salt solution. Dog was placed with head  
 elevated about 12 inches. Section 1 shows the reaction caused by 60 mm. of Hg increased intrapulmonic pressure. No bubbles  
 appeared in the carotid trap upon release of intrapulmonic pressure. Section 2 shows the reaction resulting from an intrapulmon c  
 pressure of 80 mm. Hg. Numerous bubbles appeared in the carotid trap upon release of intrapulmonic pressure.

hilus vessels of the lungs. Dissection of the lung substance showed that the emphysema about the blood vessels extended to the periphery. Hemorrhagic areas were found in the areolar tissue about these vessels and extending into the lung substance. There were also hemorrhagic areas on the lung surfaces, especially of the lower lobes. Microscopic study of sections of such lungs revealed very uniform types of damage as shown in Figure 5. Dissection of the bronchial tree revealed hemorrhagic areas surrounding these structures. Dissection of the lymphatics and thoracic duct showed no air in these structures. Air emboli were found in the coronary, mesenteric, and surface vessels of the brain. Aspiration of the heart showed air in both ventricles. In a similar experiment the vessels of the heart were ligated, the heart removed and placed under water. An inverted glass funnel filled with water was placed over the immersed heart, which was then opened and 77 c. c. of air collected from the chambers.

In numerous experiments we were able to demonstrate that intratracheal air pressures of more than 90 mm. of Hg produced immediate traumatic air embolism with resultant serious injury—injury of such a degree that recovery occurred slowly or not at all. When the air pressure was 80 mm. of Hg or less, the systemic blood pressure returned to normal, and the animals, if injured at all, were never in a serious condition.

*Discussion.*—In our opinion the production of air embolism is explained in the following manner: With an intrapulmonic pressure of 80 mm. Hg or more there is a stretching and tearing of many alveolar walls and the contained capillaries. Air is forced into these vessels and their supporting tissues while the pressure is maintained. The amount of air passing into the vessels and the interstitial tissues depends on the degree of the intrapulmonic pressure attained and the length of time this increased pressure is maintained.

Joannides (6) stated that air reached the heart through the pulmonary vessels after the release of increased intrapulmonic pressure where it was broken up into fine bubbles, and may have caused death by anoxemia and asphyxiation. Some of the air passed through the heart into the general circulation, where it was seen as air bubbles in the vessels and reached vital areas with the resulting hemiplegia, shock, unconsciousness, and death.

It is our opinion that the short time it takes for the air emboli to travel from the heart to a vital area accounts for the period of no symptoms between reaching the surface and the appearance of disaster as found in all the reported cases. The character and severity of the symptoms depend on the vital area affected.

Van Allen et al. (8) give the following excellent discussion of the effect of position of the body in distribution of the bubbles:

The influence of air buoyancy on its distribution determines distinct differences in various positions of the animal. A typical pattern of embolism, with but slight individual variations, is found in any given position. Thus, in the dorsal recumbent horizontal position air quickly leaves the pulmonary vein and left side of the heart, passes into the aorta, the arch of which is distinctly at a higher level than the descending portion of that vessel, and acts as a trap to hold a large part of the air which passes into the great arch branches. Thus more than half of the air in the circulation may go to the head, neck, and upper extremities. Distributed in this uneven manner, the air in form of bubbles is driven to the periphery. The capillaries hinder but do not prevent the passage, and after a minute or so air begins to return by the veins to the right side of the heart, thence thrown into the lesser circulation. No air succeeds in passing through the pulmonary capillaries, but is held in the arterial tree, obstructing the lesser circulation partially and gradually disappearing by absorption into the blood and tissues and by excretion into the alveoli.

Air remains longest in the peripheral arteries, sometimes for several hours, for a shorter time in the pulmonary arteries, right side of the heart, and great veins; no longer than one-half hour in the coronary arteries and only for a few seconds in the pulmonary veins and left side of the heart. Thus the period of time that elapses between embolism and death determines largely the position of the air at autopsy.

With the animal in the vertical position, air is distributed only to those parts lying above the level of the heart. Accordingly when the head is up, the head, neck, and forelegs receive the air totally, except a slight amount in the coronaries; when the head is down, the trunk and hind legs receive air, and the coronaries are heavily involved.

### THIRD GROUP OF EXPERIMENTS

#### *The effect of pressure plus distention in causing air embolism*

In our previous experiments air embolism was produced by increasing the intrapulmonic pressure with corresponding distention of the chest. The questions then asked were: Is it the increased pressure alone, or the increased pressure plus the lung distention, which is responsible for the formation of air emboli? If it is the pressure alone, why do not more people develop air embolism? The pressure necessary to cause the air to pass out of the lung into the capillaries is not great and can be produced with moderate expiratory effort by the voluntary contraction of the respiratory muscles while the breath is held, as, for example, coughing or blowing a wind instrument.

In perusing the literature it was found that air embolism is more frequent than commonly supposed, but if air embolism is not massive it can be borne by the body, provided lodgment in a vital area is escaped. (Joannides 6.)

Experiments were undertaken to clarify the above questions. The apparatus used was the same as that in the preceding experiment, plus a firm bandage applied to the animal's chest and abdomen, just tight enough to splint the chest at deep inspiration. The abdominal

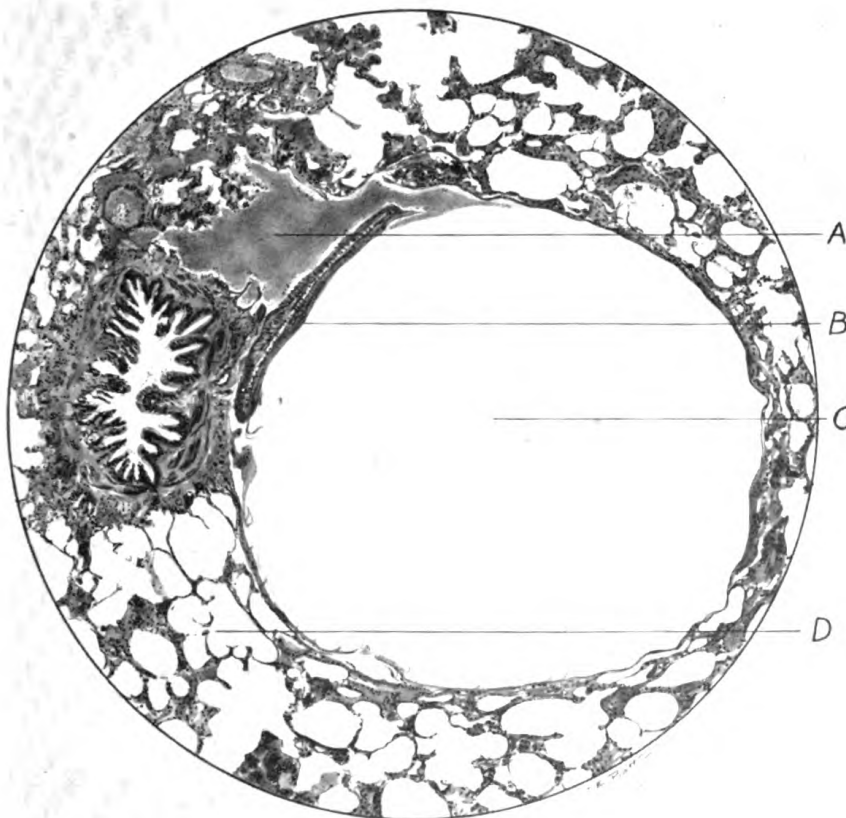


FIGURE 5.—CAMERA LUCIDA DRAWING OF SECTION OF LUNG, X 60. EXPERIMENT NO. 31 OF NOVEMBER 20, 1931

A, Perivascular hemorrhage; B, pulmonary vein collapsed by C, air pocket (interstitial emphysema); D, emphysema with rupture of alveoli.

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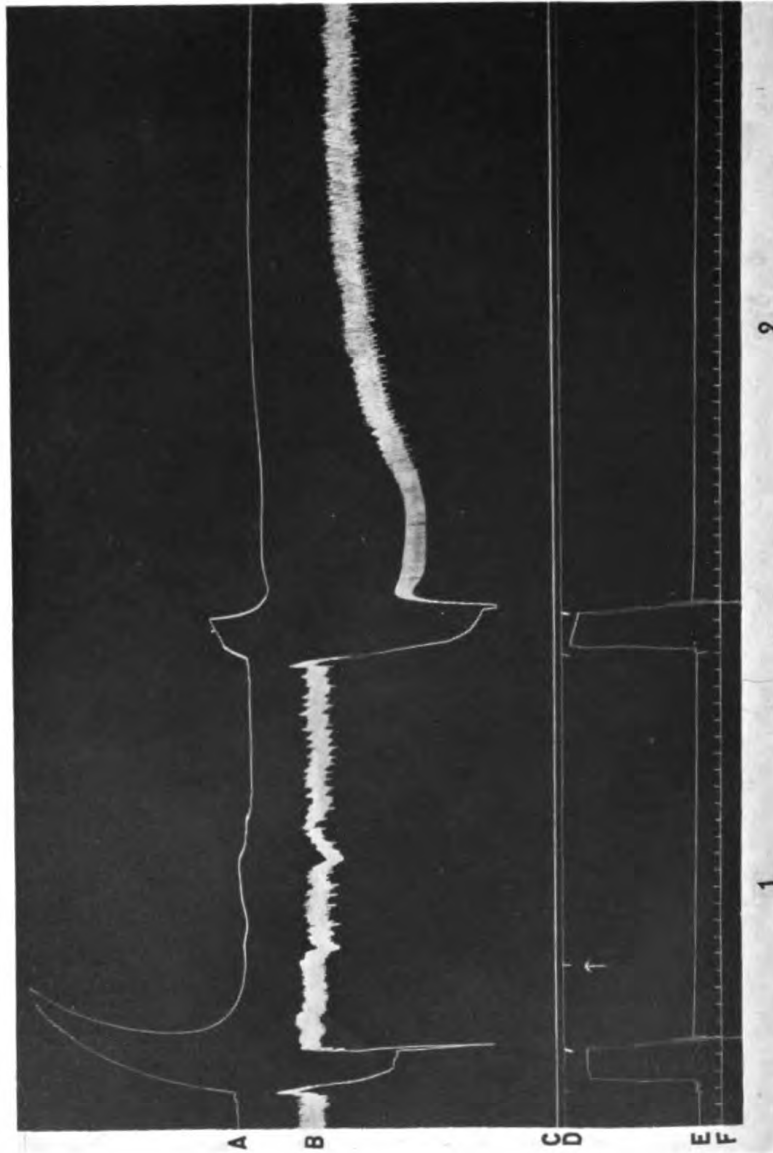


FIGURE 6.—EXPERIMENT NO. 19 OF NOVEMBER 2, 1931. DOG, 17 KG. NEMBUTAL. CHEST AND ABDOMEN BANDAGED TO RESTRICT OVEREXPANSION OF CHEST WALL AND ABDOMEN

Section 1 shows the effect on femoral and venous blood pressures by an increase in intrapulmonic pressure of 80 mm. Hg when the chest and abdomen were bandaged; section 2, the effect on the femoral and venous blood pressures by 80 mm. Hg increased intrapulmonic pressure after the bandages were removed. No bubbles appeared in the carotid cannula in section 1 after the release of intrapulmonic pressure, but numerous bubbles appeared in the carotid trap in section 2 after the release of the intrapulmonic pressure.



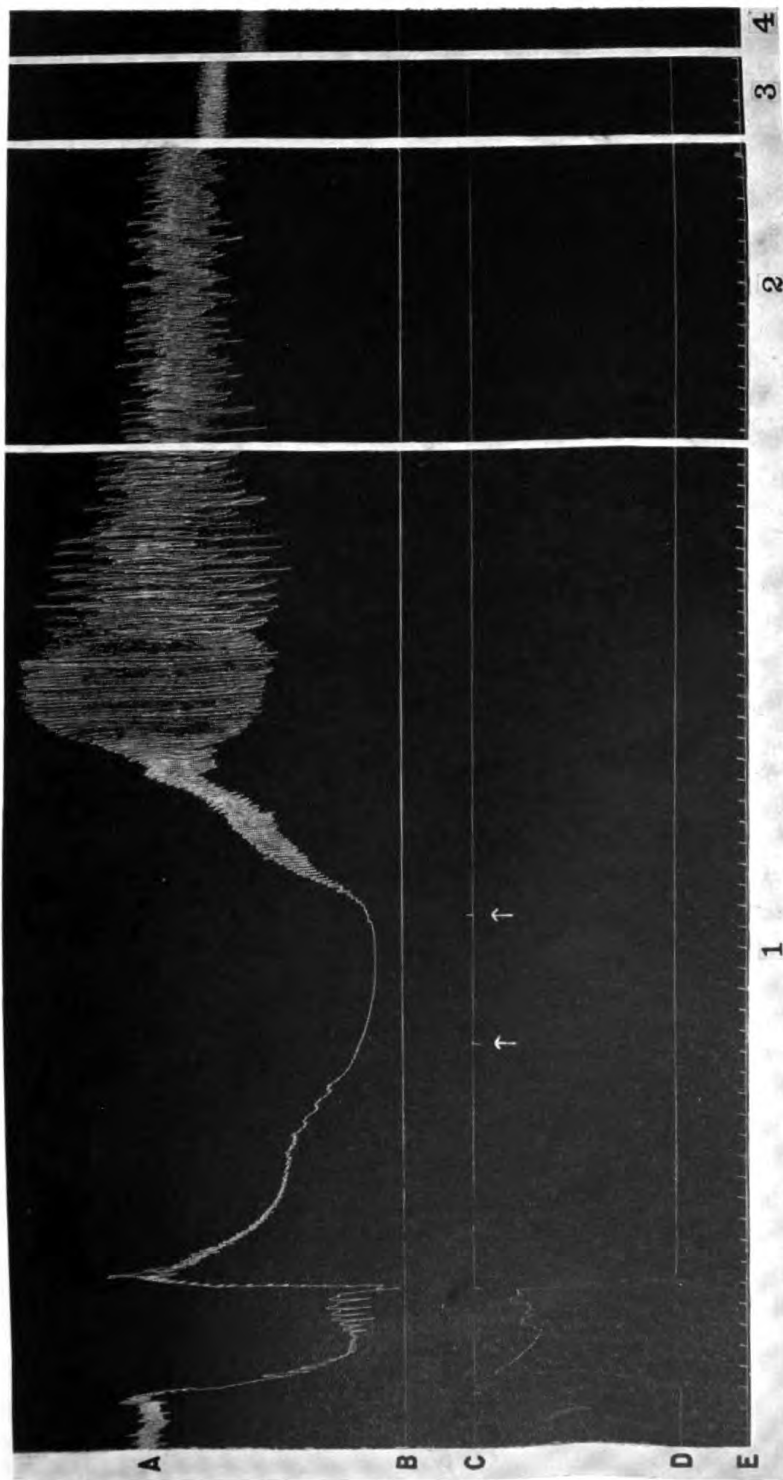


FIGURE 7.—EXPERIMENT NO. 22 OF NOVEMBER 4, 1931, IN THE RECOMPRESSION CHAMBER. DOG, 17 KG. NEMBUTAL  
 Section 1 shows the effect of 120 mm. Hg increased intrapulmonic pressure on the femoral blood pressure; section 2, of partial recovery during compression to  
 45 pounds pressure in the recompression chamber; section 3, of femoral blood pressure following decompression after a compression period of one hour;  
 section 4, of femoral blood pressure 12 minutes after decompression.



bandage was applied to prevent the *distention of the lungs* by the increased intrapulmonic pressure.

*Experiment 19, November 2, 1931, Figure 6.*—Increased intrapulmonic pressure fixed with chest bandaged and after releasing the bandage: The intrapulmonic pressure was increased to 80 mm. Hg and held for 10 seconds. No bubbles appeared in the carotid cannula after the pressure was released. An initial increase in the systemic blood pressure resulted when the pressure was first applied, followed by a rapid fall to 46 mm. Hg. With the release of the intrapulmonic pressure the blood pressure very soon returned to normal. The venous pressure rose markedly when the intrapulmonic pressure was raised, 300 mm. water, but returned quickly to normal on release of intrapulmonic pressure. After a short interval the bandage was removed, leaving the chest free to expand, and the intrapulmonic pressure again raised to 80 mm. Hg. *With the release of this pressure bubbles appeared in the carotid trap.* While the intrapulmonic pressure was raised, the systemic blood pressure fell to 42 mm. Hg and the venous pressure rose to 55 mm. of water. Following the release of the intrapulmonic pressure the systemic blood pressure returned to normal, but more slowly than when the chest was bandaged.

*Discussion.*—From the above it will be seen that the increased intrapulmonic pressure which has always produced air embolism in an animal will fail to do this if the chest is bandaged to prevent abnormal distention of the lungs. From this fact it is certain that the increased intrapulmonic pressure is not alone responsible for the production of air embolism, but the increased pressure plus the degree of distention of the chest beyond the physiological inspiratory limits are the combined factors concerned. This explains why it is possible for a man to make an expiratory effort which raises the intrapulmonic pressure to 100 mm. Hg or more without developing symptoms of air embolism, for in this case the high pressure is caused by compression of the lung volume rather than by distention.

#### FOURTH GROUP OF EXPERIMENTS

##### *The therapeutic effect of recompression on traumatic air embolism*

As shown above air embolism is the condition which has to be prevented and, when it occurs, treated. As also shown previously in this paper, and by other investigators, small air emboli can be tolerated by the body and may account for the milder symptoms which have occurred in most of the reported cases. The severe and fatal cases were, no doubt, due to massive air emboli lodging in the vital areas, especially the respiratory center or the coronary circulation. In this relation it should be remembered that in all the cases

reported the embolism occurred with the individual in the head-up position, which is conducive to the emboli reaching the brain.

Van Allen et al. (8) have found that air embolism produces two types of symptoms in man: (a) Neuromuscular, (b) cardiovascular, or a combination of both.

(a) In the neuromuscular type the onset may be abrupt with unconsciousness and death, or may manifest itself by dizziness, fainting, parasthesias, aphasia, and visual disturbances. In the more serious cases, where death is not immediate, one may see unconsciousness, hyperpnoea, Cheyne-Stokes respiration, and unequal and dilated pupils. Convulsions with unconsciousness may occur at any time. Symptoms may abate and recovery begin at any stage, but persistent paralysis may be left. Death may be delayed for some time but usually occurs within six days.

(b) In the cardiovascular type the symptoms are irregular pulse and asphyxia with gradual or sudden heart failure. In our experiments this latter type was rare, as the animals either died from respiratory failure when the pressure was released or made a good recovery.

Johnson and Luckhardt (9) found that sudden forceful inflation of the lungs in man and animals results in a vagus reflex that profoundly slows the heart and depresses the blood pressure. When the experiment was carried out on animals death sometimes resulted. Johnson and Van Allen (10) proved that this reflex originates in the lung.

With all these facts in mind two definite measures were suggested as possibly beneficial. The first of these consisted in the continuous intravenous injection of a dilute adrenalin solution. One-half a cubic centimeter of 1 to 1,000 adrenalin in 30 c. c. of physiological salt solution was given to animals, obviously seriously injured by air embolism produced in the manner described, and with arrangements for recording, identical with previous experiments. The results were not impressive. The injection never did harm and sometimes was of transient benefit. The best that can be said for the use of adrenalin is that in cases of cardiac type it may be valuable if combined with other treatment. Theoretically, if bubbles of nitrogen are lodged in the coronary vessels the effects of adrenalin in increasing the vigor of the heart beat and dilating the coronary vessels should be useful in getting rid of the bubbles.

The second method of treatment consists in recompression. Nearly all of the reported cases have been recompressed in a compression chamber, occasionally with promising results. The condition now known definitely to be due to air embolism, it was decided to experiment with compression of the animal after obvious injury had been produced by increased intrapulmonic pressure. This was accom-

plished by moving all the apparatus previously used, with the exception of the venous pressure recorder, into a compression chamber.

The experiments were carried on just as previously outlined, but when the blood pressure failed to rise, after intrapulmonic pressure had been released, and the recovery of the animal became doubtful, compression was started in the chamber and continued to 45 pounds gauge. It required about six minutes to reach this pressure. Records were made on the kymograph and observations were made through the ports of the chamber during this time. If the animal's respiration had not failed it was noticed that when the pressure in the chamber was between 10 and 15 pounds the blood pressure began to improve markedly, and this continued until the limit of pressure (45 pounds) was reached. A typical record is as follows:

*Experiment 22, November 4, 1931, Figure 7.*—Before starting the experiment the blood pressure was 170 mm. Hg and after release of intratracheal pressure rose to normal, then dropped suddenly to 18 mm. Hg, where it remained for some seconds with prospects of recovery very doubtful. Compression in the chamber was started and, as previously noted, on reaching the pressure between 10 and 15 pounds blood pressure began to rise and continued until it was 124 mm. Hg when the pressure in the chamber reached 45 pounds. Exposure of the animal was continued at this pressure for about 20 minutes, when decompression was started by the stage method according to the admiralty table for one-half hour exposure. After reaching atmospheric pressure the blood pressure of the animal dropped to 94 mm. Hg, but the animal was in fairly good condition and was killed with chloroform for autopsy. This examination revealed extensive interstitial emphysema of the mediastinum, as marked, if not more so, as in animals dying of excessive pressure alone. Isolated air bubbles were visible in the coronary arteries and veins. The heart was markedly dilated and small air bubbles appeared on the surface when it was opened under water. Emphysema was present about the vessels at the roots of the lungs and hemorrhages on the lung surfaces. Some bubbles were present in the surface vessels of the brain.

This experience was repeated with practically the same result. These experiments proved to our minds quite conclusively that compression is indicated in traumatic air embolism. It should be resorted to immediately and the pressure raised as rapidly as possible while the patient is kept in a position with the head down and the feet up. Adrenalin in physiological salt solution should be at hand and should be given slowly intravenously. The pressure in the chamber should be raised until the major symptoms are relieved. The patient should be kept at this pressure for a short time. Decompression should be slow and by the stage method. Should symptoms or signs recur dur-

ing decompression, recompression should be immediately resorted to. The result obtained by compression is purely mechanical. The maneuver causes a diminution in the size of the bubbles, thus lessening the obstruction to blood flow in the vital areas and decreasing the anoxemia. It also aids in hastening the elimination of air by absorption in the blood and excretion through the lungs. The compression tank in which these experiments were carried out was limited to a pressure of 45 pounds, which is probably inadequate to give the best results. In cases with respiratory failure artificial respiration with oxygen and  $\text{CO}_2$  should be instituted immediately and continued while compression is taking place. On reaching the maximum pressure, if artificial respiration is still needed, the oxygen and  $\text{CO}_2$  may be discontinued.

#### SUMMARY

*(A) The causes of accidents which occurred in submarine escape training:*

1. The symptoms and fatalities resulting during lung training are not due to failure of the right ventricle from inability to cope with high pulmonary blood pressure.

2. Increased intrapulmonic pressures causing overdistention of the lungs, sufficient to rupture alveolar walls, are the factors concerned in the production of air embolism.

3. Air emboli originating in the pulmonary circulation are carried to the left side of the heart and then distributed through the systemic circulation. This alone is the cause for the accidents that have occurred.

4. Severity of the symptoms from air embolism depends on the amount of air in the circulation and the vital areas involved.

5. Position of the body determines the distribution of these emboli.

6. Under experimental conditions in animals and under natural conditions in man air embolism can be prevented, except under extremely abnormal conditions of pressure, by limiting the chest distention.

*(B) The prevention of accidents occurring during "lung" training:*

1. All men being trained in the use of the submarine escape apparatus (Momsen "lung") should become thoroughly familiar with the problem of breathing while wearing the "lung" under water prior to attempting an escape.

2. It should be emphasized that continuous and rapid breathing *must* go on during the ascent.

3. The men should be completely familiar with the method and purpose of venting the "lung" through the flutter valve.

*(C) The treatment of traumatic air embolism is as follows:*

1. Absolute rest with the body in moderate head-down position. Warmth.

2. Immediate compression to at least 6 atmospheres gauge.
3. Artificial respiration. If necessary Oxygen-CO<sub>2</sub> inhalation may be used.
4. Intravenous adrenalin 0.5 c. c. in 30 c. c. physiological saline.

#### ACKNOWLEDGMENTS

The writers wish to express their thanks and appreciation to Prof. C. K. Drinker, to whom we are indebted for the outline of these investigations and for his suggestions and criticisms which made this study possible. We also wish to express our thanks to Mr. Louis A. Shaw, Miss Madeleine E. Field, and Mr. Robert M. Thomson and other members of the Harvard School of Public Health for timely suggestions and technical assistance in the performance of the experiments.

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#### ANALYSIS OF ACCIDENTS OCCURRING IN TRAINING WITH THE SUBMARINE "LUNG" <sup>1</sup>

By A. R. BEHNKE, Lieutenant (Junior Grade), Medical Corps, United States Navy

This paper reports a fatality occurring in training with the submarine escape appliance or "lung," and discusses the etiology, treatment, and measures for the prevention of these accidents.

#### REPORT OF FATAL CASE

In May, 1931, at La Playa, San Diego Harbor, Calif., 376 men were qualified in the use of the "lung," while 64 (17 per cent) were dis-

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<sup>1</sup>EDITOR'S NOTE.—The author's conclusions in regard to the physiological mechanism and treatment of cases of accident in training with the submarine "lung" have been confirmed by the experimental work of Doctors Polak and Adams, presented in this issue of the Bulletin. Doctor Behnke's article was received for publication prior to that of Doctors Polak and Adams.

qualified—22 on physical examination, 31 in the recompression chamber, and 11 in actual training. During the training one fatality occurred.

*Method of "lung" training.*—The candidates were examined on the day of training aboard the U. S. S. *Ortolan*, over the side of which ship, by means of a diving bell, the training was conducted.

The physical examination was carried out as at present prescribed by Bureau of Medicine and Surgery form letter S94(064) of July 30, 1931, except that each candidate was subjected to 10 pounds pressure in the recompression chamber in place of 50 pounds pressure.

Those qualifying physically were divided into groups of six to eight men and instructed in the use of the "lung." The following principles, which may be regarded as the laws of "lung" training, were stressed:

1. Correct breathing.
2. Slow ascent.
3. Confidence in the use of the "lung."

A group of men was then lowered in the bell with a competent instructor. The instructors were a carefully selected group and had already qualified the "S" boat personnel at Pearl Harbor, in 1930.

Each candidate was instructed to take 10 breaths outside the bell, then to ascend slowly and at the 10-foot bobbin on the escape line to stop and count 10 breaths again before completing the ascent. Before leaving the bell a candidate breathed with the "lung" under water. Having accomplished this, he left the bell and grasped the line leading to the surface. The instructor did not allow a man to ascend until he had a firm grasp on the line and was breathing properly.

If a man had any difficulty in breathing, was apprehensive, or appeared abnormal in any way, the bell was raised to the surface and the candidate disqualified.

Two ascents were made, the first from a depth of  $7\frac{1}{2}$  feet, the second from a depth of 15 feet. Any difficulties during the first ascent disqualified a candidate from further training. The "lung" was charged with oxygen in the bell at a pressure corresponding to the depth.

Case (C. A. M.), fatal, was the three hundred and seventy-seventh man to undergo training. He was 32 years of age,  $69\frac{1}{2}$  inches tall, weighed 169 pounds, well developed physically, in excellent health, and had had no sick days since his entry into the service in 1918. He completed the  $7\frac{1}{2}$ -foot ascent without difficulty. While awaiting the 15-foot descent in the bell, the group of which he was a member was instructed "to come up slowly and breathe into the 'lung'." C. A. M. was the only member of the group to reply, and Chief Gunner Kaiss recalls him saying, "Yes; I understand more about it now."



He was then lowered with the other members of the group and the instructor to the 15-foot level. He was the third or fourth member to leave the bell, which had just previously been raised to the surface in order to release a candidate who had a minor complaint. C. A. M. was breathing properly with the "lung" device in the bell. He then ducked from under the bell, paused at the 15-foot level for the requisite number of breaths and began a slow ascent to the surface.

Upon reaching the surface, he was instructed to close the valve of his "lung," which he did. No abnormality was noticed at this time. He swam a few feet to the ladder, started to climb up, but fell backward into the water. He was brought out of the water immediately and artificial respiration administered.

When brought on board the *Ortolan* (within a few seconds) he was unconscious. His face was changing from a gray pallor to cyanosis. In a few seconds the head and neck were markedly congested. Pupils were slightly dilated. There was some blood oozing from the nostrils. The skin was cold and the trunk and limbs were flaccid. Respiration had ceased, radial pulse was absent, and the apex heartbeat could not be felt. Artificial respiration, continued for one hour, brought no response. The application of heat, massage, epinephrine, and oxygen were of no avail. It is thought that death occurred immediately after removal of the body from the water.

An autopsy was performed five hours later by Lieut. Commander W. W. Hall, Medical Corps, United States Navy, of the United States naval hospital, San Diego, Calif.

*Summary of the necropsy report.*—The body was that of a well-developed, well-nourished, white male of approximately 30 years of age. Bloody fluid exuded from both nostrils.

1. Multiple areas of hemorrhage throughout the lower lobes of both lungs and the middle lobe of the right lung, with subpleural hemorrhages over the above areas.
2. Dilatation of the right ventricle.
3. Subarachnoid hemorrhages over the superior precentral areas of both sides of the cerebrum.
4. Congestion of the liver, kidneys, and spleen.

The exact mechanism causing death in this case is unknown. Increased intrathoracic pressure may have been a factor and, if so, would explain the autopsy findings. But it is known that the individual was breathing at 15 feet and that he apparently ascended slowly. If he held his breath, the maximum intrathoracic pressure developed on ascent would not have exceeded 6.5 pounds per square inch, unless forced expiratory efforts with a closed glottis were made. The circumstances were somewhat similar to the fatality occurring at Pearl Harbor in 1930, except that in the latter case, ascent was apparently more rapid, and air was found in the peripheral circulation at autopsy.

#### THE MECHANISM OF INJURY FROM INCREASED INTRATHORACIC PRESSURE

It is known that accidents occur when men ascend too rapidly, particularly with breath holding. From the beginning of "lung" training, slow ascent and proper breathing have been recognized as

principles requiring strict adherence. It follows that in excessively rapid ascent increased intrathoracic pressure tends to result. It is therefore concluded that increased intrathoracic pressure is undoubtedly the main factor.

The manner in which this operates to produce the symptoms observed is largely a matter of speculation.

The theories advanced to explain the mechanism of injury from increased intrathoracic pressure are:

(1) *Analogy with the Valsalva experiment.*—MacClatchie (1) drew an analogy between the changes occurring in the Valsalva experiment and the symptoms manifested during accidents in "lung" training. It is assumed that increased intrathoracic pressure in the Valsalva experiment (a) constricts the lumina of the venous trunks, thereby impairing blood flow to the right side of the heart; (b) forces blood out of the left side of the heart; and (c) presses on the heart wall. These factors may result in a withdrawal of the heart content of blood, and it was stated that this mechanism may cause a definite train of symptoms such as dizziness, loss of consciousness, and fall in blood pressure with absence of radial pulse.

Comparing this experiment with the cases reported by MacClatchie many similarities are noted. There are also discrepancies. Thus in cases 1, 2, and 3 an interval elapsed between the period of increased intrathoracic pressure and the appearance of symptoms.

In case 1 the individual reached the surface, spoke to the instructor, and removed the "lung" before losing consciousness.

In case 2 he climbed out of the tank, removed the "lung", walked over to the window, then slowly collapsed.

In case 3 the individual reaching the surface appeared normal for a period of 30 seconds or so; about a minute later he slowly collapsed.

Now in these intervals it is reasonable to suppose that the individuals resumed breathing. If so, the conditions of the Valsalva experiment were unfulfilled in that increased intrathoracic pressure was not existent at the time when symptoms began to appear in these cases.

(2) *Direct entrance of air into the general circulation*—(a) *Through stomata of alveolar walls.*—Bichat, quoted in (2), reported in 1808 that when air is blown into the lungs of a living animal at a pressure no greater than the maximum expiratory effort of the animal, the pressure being maintained, air will leave the alveoli and enter the pulmonary capillaries. Enough air may thus be forced into the general circulation to cause death. Ewald and Kobert, quoted in (2), reported that this phenomenon is not one of alveolar rupture but of escape of air through normal stomata in the alveolar walls in animals when a certain degree of distention is

reached. The existence of such stomata, however, has never been confirmed. On this principle has been explained the finding of air occasionally in the cavity of the left side of the heart of persons drowned or hanged and of infants who have received strenuous resuscitative measures. Neuberger, quoted in (2), suggested that the convulsions which sometimes occur in whooping cough are from cerebral embolism, air being forced directly into the blood stream from the alveoli during a paroxysm of coughing. At autopsy in these cases confirmatory evidence has been found in lesions of the brain.

The clinical picture presented by air in the blood stream forced through the alveoli or the pulmonary veins may be very similar to the "lung" accident cases. Thus according to Van Allen et al. (2), symptoms may be distinctly of two types, namely, neuromuscular and cardiovascular, or a combination of both. Cardiovascular symptoms consist in pulse irregularities, asphyxial signs, and evidence of gradual or sudden heart failure. Nervous symptoms are varied. The onset may be precipitated with unconsciousness and death or it may be ushered in more gradually, beginning with dizziness, faintness, local or general paresthesia, aphasia, and visual disturbances. More serious symptoms are hemiplegia and paraplegia. At any stage symptoms may begin gradually to disappear and the patient to recover.

Compare these symptoms with those of case 3 (1):

About a minute later he slowly collapsed in the water \* \* \* The extremities and body were cold and muscles were rigid. Breathing was shallow and rapid and the pupils were dilated, but reacted to light. The radial pulse was absent and the heart seemed slow and weakened. After about 15 minutes the patient began to make groaning sounds and to roll his eyes about \* \* \* He was then dressed, but gave no assistance to this act and made thrashing, and apparently hysterical, movements with the arms and legs \* \* \* When seen about a half hour later he complained of loss of vision, even to light, and anesthesia of the left foot and leg.

Again case 6 (3): "He was unable to breathe on reaching the surface and collapsed in a few moments, becoming unconscious with sensations of numbness, aching, and prickling of the extremities \* \* \*" In a personal communication this individual stated "that in moving him his feet were dragged on the ground and some of the skin scraped off. He felt no pain at the time (*anesthesia*), and though conscious, he was unable to lift his feet off the ground (*paralysis*)."

How can analogy with the Valsalva experiment possibly explain the above cases? We must seriously consider air in the circulation as a very important factor in these cases. If air can be forced into the blood stream during a paroxysm of whooping cough, it certainly

might enter during rapid ascent with breath retention where the intrathoracic pressure might be theoretically increased to 16 pounds per square inch or more.

(b) *From rupture of pulmonary vessels.*—In support of this theory may be cited numerous cases from the literature of air entering a pulmonary vein during surgical procedures including the production of artificial pneumothorax. Many such cases of air embolism were at one time considered to be due to "pleural shock" because of the few findings at autopsy, presumably due to the difficulty of locating ruptured vessels and of finding small amounts of air.

It is seen how the rupture of pulmonary capillaries might occur as a result of increased intrathoracic pressure and which would result in the introduction of air into the circulation.

Thus in the fatal case occurring during lung training at Pearl Harbor in 1930 (4), the individual came up rapidly from 30 feet with the "lung" and lost consciousness upon reaching the surface. Eight ounces of blood-stained fluid were discharged from the mouth when artificial respiration was started (indicating rupture of pulmonary vessels?). At autopsy, in addition to other findings, the bronchi contained bloody mucous; air bubbles lifted the visceral pleura of the lungs in many places, the bubbles varied in size from 1 mm. to 10 mm. in diameter; heart was firm in consistency and on compressing the base air bubbles could be felt passing into the aorta; numerous air emboli could be seen in the veins on the surface of the heart and on opening the left ventricle a quantity of frothy blood escaped.

The most probable way for such a large amount of air to enter the blood stream would be through ruptured pulmonary vessels. That a short exposure to 20 pounds pressure in a recompression chamber in an individual with retarded circulation, would produce large bubbles on decompression is improbable. In fact this pressure roughly corresponds to that at a depth of about 42 feet from which a diver may ascend rapidly without decompression. Bubbles of gas therefore, arising on decompression in the blood stream would not be sufficient to cause symptoms.

In summary it may be stated:

1. The exact mechanism operating to produce these accidents is a matter of theory and may be due to any one or a combination of factors.

2. That compression of circulation (analogy with the Valsalva experiment), as brought out in the Naval Medical Bulletin of July, 1931, is not the main factor is obvious from the very nature of many of the symptoms in these cases, and from the "breathing interval"

elapsing before symptoms appear and during which no compression of circulation exists.

3. That symptoms and signs such as paraylses, anesthasias, parathesias, and convulsions are due to air entering directly into the circulation and tissues is very plausible. Moreover, the time necessary for the mobilization and coalescence of such air bubbles would explain that varying interval of time elapsing between the onset of increased intrathoracic pressure and the appearance of symptoms after release of the pressure.

#### TREATMENT OF "LUNG" CASUALTIES

There is a difference of opinion in regard to the use of the recompression chamber in the treatment of accidents under depths of 42 feet. Reasoning from the theories advanced and from the symptoms exhibited in these cases of accident, the therapeutic use of the recompression chamber is indicated as follows:

Reduction of the size of gas bubbles in the blood stream and tissues leading to gradual absorption and thus removing the block in the blood vessels.

Moreover, experience has apparently proved the value of the recompression chamber. As Adams (5) emphasized, not only are many of the symptoms exhibited by these cases suggestive of caisson disease but they are ameliorated by the use of compressed air.

In the cases presented in the Naval Medical Bulletin of July, 1931, by MacClatchie (1) and Brown (3), the recompression chamber appeared to be of definite value.

Thus case 1: "At a pressure of 10 pounds he revived and the body warmed up. At 15 pounds he appeared completely normal \* \* \*"

Case 3: Collapse followed by traumatic neurosis. Pressure raised to 25 pounds but no improvement. If, as suggested in a previous paragraph, gas bubbles were a factor (either by solution or by being forced into the circulation as a result of increased pressure), the pressure of 25 pounds may have been insufficient to give relief.

Case 4: "He was recompressed to 40 pounds and decompressed over a period of 35 minutes, during which time he reacted. The numbness and prickling cleared up in two hours but headache persisted for 24 hours. There were no other sequelae."

Case 5: "He was recompressed to 30 pounds and decompressed in 49 minutes with rapid improvement. General weakness again set in with severe headache in about 45 minutes. During a second recompression he obtained permanent relief."

An additional case illustrating the possible value of recompression is the following:

Case (O. G. U.) (6): A man of 20, in excellent health, was exposed seven minutes at 33 feet depth. He was using a regulation helmet

which he ducked and came to the surface. He swam toward the ladder, appeared in good condition, then suddenly had difficulty. He was thrown a line and when brought on the deck appeared somewhat exhausted. He stated that the right arm and leg seemed to become suddenly paralyzed and that he had difficulty in breathing. He had previously ducked the helmet at 33 feet without ill effects, so it was thought that his symptoms would not be alleviated by recompression. The outcome of this case was that intermittent convulsions continued for two days, recompression at 25 pounds pressure was of no value, but a second exposure to 75 pounds pressure markedly improved the patient, and he returned to duty in three days completely cured.

Thus evidence based on the result of treatment indicates the value of compressed air therapy and indicates that the etiology of these accidents is the formation of gas bubbles in the blood stream and tissues. By what other theory can the delayed appearance of convulsions, paralyses, parathesias, and anesthetics be explained? All of the individuals in these cases were not neurotic or hysterical. They either had previous successful training with the "lung" or in diving and following their accidents continued diving or "lung" training without mishap. Case 6 (3), and case O. G. U. (6) may be cited as examples. Whether the air was forced into the blood vessels as such or dissolved in the blood, has been dealt with. The fact remains that in the case of O. G. U., for example, convulsions did not stop until 75 pounds pressure had been applied.

Additional treatment varies according to predominating symptoms. In a case with water in the lungs, for instance, it would be necessary to employ resuscitation accordingly. All the methods of resuscitation can be carried out in the recompression chamber during the recompression.

#### CONCLUSIONS

1. The exact physiological mechanism responsible for accidents in training with the "lung" is largely a matter of theory, but the introduction of air in the form of bubbles resulting from sudden increase followed by abrupt release of intrathoracic pressure probably plays an important rôle.

2. Clinical experience indicates the value of the recompression chamber in the treatment of this type of injury.

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### RENAL CALCULUS<sup>1</sup>

#### A REPORT OF OPERATIVE CASES

By V. H. CARSON, Lieutenant Commander, Medical Corps, United States Navy

One hundred and sixty-three patients with renal calculus were treated at this hospital during the past two years. Fifty-five operations were performed upon 46 patients of this group, and we wish to present certain data collected by a review of their clinical charts. In addition we would like briefly to state our attitude toward certain very interesting phases of this work.

The average age of patients in this group was 36 years. The youngest patient was 28 and the oldest 63.

The 55 operations performed upon the 46 patients were as follows:

Pyelolithotomies.....	34
Nephrolithotomies .....	14
Nephrectomies.....	7

The distribution of stones in these cases were as follows:

Single stones.....	25
Multiple stones.....	14
Bilateral stones.....	7

*Complaint on admission.*—The most frequent complaint on admission was pain located in the region of the kidney in the angle between the last rib and the erector-spinae muscle. Twelve patients were in renal colic on admission; 4 patients with bilateral renal calculi with infection had no pain referable to the uro-genital tract; 30 cases complained of discomfort with occasional aching pains in the region of the kidney referred at times to the groin, testicular region, and upper thigh.

Macroscopic hematuria was present in 12 cases and marked urinary frequency in 10 cases.

*Past urinary history.*—In 35 per cent of the cases there was a history of previous attacks of renal colic; 20 per cent had previously passed calculi; 18 per cent admitted previous attacks of hematuria;

<sup>1</sup> From the Urological Service, U. S. Naval Hospital, Brooklyn, N. Y. Read before the Brooklyn Surgical Society, December 2, 1931.

and 15 per cent had submitted to appendectomy because of pain in the right side.

*Urological examination.*—Palpation over the region of the affected kidney elicited tenderness in 80 per cent of these cases. The renal function as determined by ureteral catheterization was found to be decreased in the affected kidney in 75 per cent; unchanged or normal in 11 per cent; and increased in 4 per cent. A normal dye appearance time was present in three cases which showed considerable renal damage, the total estimated function for 30 minutes being lower than 8 per cent.

Infection was present in 85 per cent of the bilateral-stone cases; in 60 per cent of the multiple-stone cases; and in 44 per cent of the single-stone cases. The *Staphylococcus albus* was the most common type of organism found. The colon group of organisms was the next most common type present, while the *Staphylococcus* and colon group together or with the *B. proteus* was the most common type of mixed infection.

Blood chemistry studies were found to be essentially negative in all cases regardless of the fact that many showed considerable renal damage with marked impairment of renal function.

The pyelographic findings were those commonly found in calculus disease and gave positive evidence of obstruction in 95 per cent.

There were no cases of calculus anuria in this group.

Uroselectan was found to be of great value, particularly in several cases where difficulty was encountered in ureteral catheterization.

*Indications for operation.*—Complaints considered as demanding operation were pain, chills and fever, hematuria, and positive evidence of urinary obstruction. Renal calculus of 1 centimeter or more in diameter producing any of the above symptoms was considered sufficient indication for operation. In deciding which side was to be operated on first, we chose the side the correction of which would most increase the total renal function.

*Preoperative care.*—It is undoubtedly true that the preoperative and postoperative care of urological patients are equal in importance to the operation itself. Plain X-ray plates of the urological tract, complete blood chemistry studies, renal function studies, and the bacteriological examinations of specimens of bladder urine were routinely carried out preliminary to any cystoscopic procedures. In cases that showed marked impairment of renal function an accurate record of total fluid intake and output was kept and liquids were forced by mouth up to 4 liters per day. If this whole amount of fluid could not be taken by mouth, part of it was given by intravenous normal saline.



We have made it a routine procedure to place a ureteral catheter in the affected side before operation for renal calculi. This may seem to be an unnecessary precaution, but we have found it of particular value in certain cases where the upper ureter and pelvis were bound down with adhesions. The ureter can certainly be found with greater ease in this way and it is believed that the catheter perhaps may serve to prevent dislodgment of stones during mobilization of the kidney. Also, we have made it a rule to make plain X-ray pictures of the urinary tract in every case with this catheter in position just before the patient goes to the operating room. Renal calculi have at times the tendency to wander off at the last minute to be found at some unexpected location, and this precaution has undoubtedly saved us many an embarrassing moment.

For the estimation of renal function we have used phenolsulphone-phthalein and indigo-carmin for both the total and differential function tests. We usually employ a large Garceau catheter on the affected side for an accurate function test and leave it in place for 30 minutes. This procedure of using a large catheter usually prevents the leakage which occurs when the ordinary catheter is used and gives us more accurate knowledge of the actual kidney function. The differential urea function tests following the administration of 15 grams of urea by mouth has been used in a large number of cases and has been found to be of value.

We have been using pyridium, caprokol, and serenium for urinary antisepsis, but from bacteriological studies carried out we are not at all certain as to the relative values of these preparations. Patients receiving urinary antisepsis by mouth were as a rule also receiving local treatment in the form of pelvic lavage with silver nitrate, so that in the final analysis it is rather difficult to determine which of these measures was responsible for the improvement.

*Type of anesthesia.*—Spinal anesthesia was used in all of the cases reported in this group. Pure novocaine crystals supplied by Metz in ampules of 50, 100, and 200 mg. (dose depending on weight of patient) dissolved in 6 or 8 c. c. of the patient's spinal fluid was used as the anesthetic. The Labat syringes and needles with the Labat technique were used.

Preoperative narcosis consisted of the administration of 10 grains of barbital one and one-half hours before operation followed by the administration of morphine sulphate grains one-fourth and scopolamine hydrochloride grains one-two hundredth hypodermatically 30 minutes before operation. Lumbar puncture as a rule was made between the second and third lumbar vertebrae. In 15 cases as high a dose as 250 mg. was used with no appreciable difference in the anesthesia and with no apparent bad effects, except in one case,

noted below. No case required any additional anesthesia. Two patients complained of some pain upon traction of the kidney pedicle. One bad reaction occurred following the administration of 200 mg. of novocaine. This patient developed marked cyanosis accompanied by considerable difficulty in breathing, but following stimulation his recovery was complete. Ephedrine hydrochloride was used in 38 of these operations, being given 5 minutes before anesthesia was administered. We have lately discontinued its use and no appreciable difference has been noted except that the blood pressure seems to drop to a much lower level without, however, any harmful effects.

We do not administer intravenous saline with glucose until the effects of spinal anesthesia have completely worn off, believing, as we do, that the introduction of large quantities of fluid preliminary to this time is of questionable value. The introduction into the circulatory system of large quantities of fluid simply serves to increase the dilation of the splanchnic area of blood vessels and thus probably serves to embarrass a circulatory system which is already operating under a big handicap. So we may say that this type of anesthesia has been completely satisfactory and that we would not hesitate to continue its use.

*Operation.*—We employ either an oblique incision which comes well forward, dividing the three muscular layers in the anterior portion of the incision, or the L-shaped incision which gives a better posterior exposure, the upper limb of this incision being made to run parallel with the outer border of the quadratus lumborum muscle and the anterior limb extending as far forward as desired. A complete mobilization of the kidney is always attempted before any operative procedure is carried out.

A pyelotomy is always done in preference to a nephrotomy unless there is some contraindication for pyelotomy. In the simple pyelotomies where little or no infection is present we attempt to close the pelvis except where the wound is very large. When infection is present the pelvis is drained with a No. 10 or 12 soft rubber catheter for a period of 24 to 48 hours. After the removal of this catheter, if there is no ureteral or pelvic obstruction, the urinary drainage will be comparatively small in amount. We obtained some urinary leakage in practically every case where a complete closure of the pelvic wound was attempted, so that more recently we have been inclined to leave them open. We noticed where the pelvis was surrounded by a considerable layer of fat that the wound in the pelvis closed very rapidly regardless of whether suture was attempted or not so that more recently in a few cases of this type with large extra renal pelvis we have incised directly through this fatty tissue to the stone without entirely clearing the pelvis and have found that urinary leakage in these cases occurs only to a very small extent.

In nephrolithotomies the kidney incision is closed with interrupted plain double catgut sutures which include the kidney capsule and a small amount of renal tissue. Small pieces of fat removed from the operative wound are placed in the line of the incision and apparently have been very effectual in blocking the severed ends of blood vessels and preventing postoperative hemorrhage. We have had no cases of postoperative bleeding in this group of cases. If a nephrolithotomy has been performed in the presence of an infection we place a No. 10 or 12 soft rubber catheter in the kidney incision and allow it to drain for a period of 48 hours. Pelvic drainage is also instituted in an occasional case where heavy infection is present. We believe that a nephrolithotomy performed in the presence of a heavy *Staphylococcus* or *B. proteus* infection is distinctly a bad operation and is to be avoided if possible.

In the aseptic or slightly infected cases where pyelotomy is contraindicated it is believed that nephrolithotomy can be performed with very good results as a rule, but where heavy infection is present with the above type of organisms recurrence of calculus formation is so common that this operation constitutes a distinct hazard and under such circumstances should be avoided if possible.

*Mortality.*—There were no deaths in this group of operations.

*Results.*—In an analysis of the group composed of 7 cases of bilateral renal calculi, 14 operations were performed and consisted of the following: 7 nephrotomies, 5 pyelotomies, and 2 nephrectomies. These operations were divided as follows: 3 cases were readmitted for operation on the opposite side; 2 cases were admitted for operation on the opposite side and later readmitted for operation for recurrence; and 2 cases were operated only on the single side. In the remaining 39 cases of the group, 29 pyelotomies, 7 nephrotomies, and 5 nephrectomies were performed, 2 cases being readmitted for operation for recurrence. We know of four other cases in this group that have suffered a recurrence but for various reasons have not resubmitted to an operation.

In 12 cases where nephrolithotomy had been performed, postoperative renal function studies were carried out eight months or more following operation. In nine of these cases the postoperative function as compared to the preoperative function was reduced and in the remaining three cases the function remained approximately the same. In one of these cases where a complete hemisection of the kidney was made for the removal of a large stag-horn calculus, renal function studies carried out 10 months and 14 months following operation showed almost a complete absence of function on that side. In this case, however, we were forced to perform this operation because of certain conditions which developed. It would have been much better had a nephrectomy been performed.

All operative wounds were completely closed when the patients were discharged from the hospital. The average time for complete closure of operative wounds was 19 days. In one case urinary drainage persisted for 62 days following a nephrolithotomy.

*Postoperative treatment.*—The forcing of fluids by mouth and urinary antisepsis is instituted as shortly as possible following operation. As soon as the operative wound is closed, or shortly thereafter, ureteral dilatation to promote urinary drainage, and pelvic lavage or instillations are carried out for the relief of urinary infection. The postoperative care of these patients, especially where infection is present, undoubtedly constitutes the most important single feature in the prevention of recurrence. Where the closure of the operative wound is delayed the insertion of a ureteral catheter for a period of 48 hours has been found to be very effectual in promoting a rapid closure of the wound.

#### SUMMARY

1. Data is submitted on 46 patients operated on for renal calculus, this group representing 55 operations.
2. Spinal anesthesia was the anesthesia of choice and was used with complete satisfaction.
3. Pyelotomy is the operation of choice for kidney stone and lessens the chance of recurrence as compared to nephrotomy.
4. Indications for operation were diminished kidney function, urinary obstruction, infection, persistent hematuria, and pain.
5. Renal function studies show that where nephrolithotomy is performed in the presence of heavy infection a loss of function with recurrence almost surely follows.
6. There were no deaths following the 55 operations for kidney stones.

#### DISCUSSION

Dr. NATHANIEL P. RATHBUN. I was interested to note that 15 per cent of the doctor's patients had appendectomies. General surgeons please note.

I noted that the doctor routinely has an X ray and various other factors in the examination before proceeding to cystoscopy. That differs a little from my routine. We have certain economic factors to consider which the doctor does not have to consider here. I have to do the whole thing at one sitting; in fact, sometimes we save the patient a lot of time and money and laboratory examinations. I rather gathered from the doctor's pictures that he does pyelograms routinely on most of his patients. I am thoroughly in accord with that. You get a good deal of information from the pyelogram, including the estimation of the renal capacity, or functions, so to speak.

The point the doctor makes about the catheter in the ureter before operation is something I never heard of before in connection with pyelotomy or nephrotomy. I think it is an excellent suggestion, particularly for the reason that it prevents the stone from slipping into the ureter.

I heartily approve of his pictures taken immediately before operation. That has been a routine with me for about 10 years, having had the experience of going after calculus and not finding it, and upon taking an X-ray picture the next day the calculus was found in the ureter.

While on the subject of X ray in connection with operations on renal calculi, I want to mention one other point, namely, X-ray study on the table at the time of operation. I think that was first suggested at the Mayo clinic and was done as a fluoroscopy. Quimby some years later suggested what I think is an improvement on that, consisting of an X-ray picture of the kidney taken on the operating table. One can get small slides, or plates, about the size of your fist, keep them in the operating room as a part of the regular equipment, wrapped up in a sterile towel, and when you are reasonably satisfied the stones are removed, a plate is placed behind the kidney, and a picture taken while the wound toilet is being completed. If all the stones are not removed then you can go after them again.

I think many of the recurrent calculi are not recurrent at all, but are stones that are overlooked at the time of operation.

The doctor, I observed, did all his work under spinal anesthesia. I can not entirely subscribe to that attitude. It seems to me that represents fitting the patient to a type of anesthesia. I use spinal anesthesia, but I think it should be selected for some good reason; we have so many ways of anesthetizing our patients now; we have a wide choice of anesthetics. Many of my patients I like to start with avertin and continue the operation with local or with a little whiff of gas occasionally, being able to complete the operation in that way. I can not help feeling, in spite of the doctor's excellent results, and in spite of many of the statistics published, that there is a little danger in spinal anesthesia, a little more risk than with some of the older forms of anesthesia.

I heartily subscribe to his attitude on the very wide incision and free mobilization of the kidney. I tell my assistants that when one starts out to do a kidney operation one never knows what accident may happen, and that it is wise to have plenty of room in order that they may be able to take care of any emergency that may arise.

Some of the large calculi shown on the screen I think called for a very high degree of judgment as to the best thing to do under the circumstances. Personally, I think that many of those should be left alone unless there is no question that they are giving perfectly definite symptoms. I feel that many of those cases have a considerable amount of pretty good functioning kidney tissue and that any effort to remove them will do more damage to the kidney than the stone itself is doing. I think that is the crux of the situation. If you think you can get a line on those with the pyelogram and you feel you have an ample renal pelvis and the stone can be removed without damage to the kidney pelvis in a young man, then I say remove it. Many of them, however, I believe in leaving alone.

In regard to the question of postoperative care of these patients, I feel that we should tell all our patients that they are apt to have stones again, or that they may have stones again. I think, leaving out the matter of calculi that are overlooked at the time of operation, there are two or three factors which enter into the problem of recurrent calculi. One of them, I think, is the obvious factor that for some mysterious reason some people have a stone-forming tendency. I don't know why that is, and I don't believe anybody else knows the reason for it. Perhaps it is a matter of colloids; we do not know just exactly how to influence them. I read a recent article which was more en-

couraging to me than anything I know of or have heard of in a long time. In this particular article the author brought out that it may be due to a deficiency of vitamin A, and if that is a fact we have there a very valuable clue to the treatment, namely, loading up the diet with foods rich in vitamin A. The second factor is infection, which the reader of the paper brought out and which Doctor Read emphasized. I am in accord with the idea of asking the patient to come back at intervals in order to pass a catheter (I believe it should be a good sized catheter) into the pelvis. I think some of these cases have obstructive lesions in and about the ureter, kinks, or ureteritis, or strictures, or whatever you like to call them, and I think it is rather important to insure drainage.

Dr. J. STURDIVANT READ. I would like to know if Doctor Carson closes his kidney wounds or does he drain the wounds after operation? Does he make it selective? If so, how long does he leave the drain in? Has he had any cases in which the early removal or the too early removal of the drain had been followed by a closure of the skin and fascia and then, after a couple of weeks, an abscess develop in the fascia at the site of the kidney wound? That has been my unfortunate experience two or three times, so that it now is a routine with me to put in a drain in every operation, as I never have seen it delay the healing.

In regard to the doctor's experience with spinal anesthesia, certainly spinal anesthesia is a delightful thing for the surgeon; it makes the operation so much easier—no deep breathing displacing the kidney up and down, more rapid work, easier to handle. In some cases I have felt that local anesthesia added such a psychic shock that I frequently use general anesthesia in kidney cases for that reason. I have never seen it interfere with the general recovery of the patient, but for surgical procedures spinal anesthesia in my hands, too, is much preferable.

There is just one point that I would touch upon in respect to the postoperative care of kidney cases. After stones have been removed I make it a routine to have all patients that I can persuade to do so return twice a year for kidney lavage through a catheter, not so much with the idea of washing out the renal pelvis as to be sure of having good drainage from the kidney. Probably the passage of the catheter up the ureters may prevent the further development of round cell infiltration, or a stricture, if there is such a thing, as being the original cause of kidney-stone formation, because whatever theories we may have of why kidney stones form, certainly the old surgical principle of anything that interferes with physiological drainage is a disadvantage is true, and it can be corrected by the passage of a sound, which is what a ureteral catheter is.

Dr. HENRY F. GRAHAM. If my understanding is correct, the standard dose used by Doctor Carson for spinal anesthesia is 250 milligrams. Labat in some of his published articles states that his standard dose is 150 milligrams, and that he never has used more than 200 milligrams. Following Labat, I have given 300 spinal anesthetics without fatality, and I think it is one of the most important advances in surgery in recent years. My fear is that you will have a fatality with larger doses.

Dr. V. H. CARSON. We used 250 milligrams on the first 15 cases. On the remainder of the cases in this group we used 200 milligrams, never using less than that amount. So far as the anesthesia was concerned, we noticed no appreciable difference. In the single case where a bad reaction occurred we used 200 milligrams.

In replying to Doctor Read's question in reference to drainage, I would say that in ordinary aseptic calculi where pyelotomy has been performed we attempt to close the pelvis without drainage if possible. Drainage of the pelvis in aseptic cases by catheter in the wound is believed to be a bad procedure for the reason that infection from the wound contamination quite often takes place during the period of convalescence. Where infection is present—for instance, a staphylococci or mixed infection—we drain the pelvis with a small soft rubber catheter for a period of 48 hours. We close the nephrotomy incisions in the absence of an infection and drain with a soft rubber catheter when infection is present. We always leave a loosely packed large cigarette drain in the upper angle of the kidney incision in addition to the smaller drains that lead directly to the kidney.

There was one important point that I failed to mention in my paper regarding the postoperative treatment of these cases. As soon as possible following convalescence they are cystoscoped and ureteral dilatation is carried out to promote urinary drainage. Ureteral dilatation and the treatment of infection are considered to be the two most important features in the prevention of recurrence. In addition, we advise these patients upon their discharge from the hospital to return in three months' time for further treatment. As a matter of fact, we cystoscope most of them two or three times before they are discharged from the hospital.

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#### A SUMMARY OF THE PRESENT STATUS OF RADIATION THERAPY <sup>1</sup>

By O. B. SPALDING, Lieutenant Commander, Medical Corps, United States Navy

The biological effect produced in the skin by prolonged exposure to X rays—an erythema followed by a dermatitis—attracted the interest of Schiff and Freund. In 1896 they (1) suggested the use of X rays in the treatment of disease. This was the beginning of Röntgen therapy.

The first therapeutic applications were made in cases of nevus, cancer, and tuberculosis. In a few months the medical literature was filled with reports of alleged cures of many diseases, so that in the lay mind, at least, X rays were hailed as a cure-all.

The history of Röntgen therapy may be divided into three periods—optimistic, pessimistic, and realistic—the first lasting until 1906, during which period many false claims were made; the second lasting until 1912. During this era radiation therapy was at its lowest ebb, due to the fact that many inexperienced physicians were attempting to treat too many diseases. With the perfection of the Coolidge tube in 1914 the practice of Röntgen therapy was revolutionized.

In 1901 Becquerel (1) discovered that radium was capable of effecting an inflammatory reaction in normal skin, leading Besnier

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<sup>1</sup>Abstract of paper read at the weekly conference of naval medical and dental officers in the District of Columbia, U. S. Naval Medical School, Mar. 20, 1931.

(1) to suggest its use for therapeutic purposes. Radium therapy thus began with the famous "Becquerel burn."

X rays and radium rays may either stimulate, inhibit, or destroy living tissues, but the action is not the same on all tissues. Sensitiveness to the rays varies with different tissues, the lymphoid and vascular endothelium being extremely sensitive to X rays.

Generally speaking, small doses of radiation give rise to transient effects, while more intensive radiation produces permanent damage or even complete destruction. Experienced workers with radium claim that in a benign lesion the smallest possible doses give the best result, while in a malignant condition the largest dose compatible with skin safety should be employed.

Physicists, biologists, and biochemists have not settled the all-important question to the satisfaction of Röntgenologists as to how rays act on tissue.

It is, however, well known that radiation has a marked inhibitory effect on the growth of neoplastic tissue with, at the same time, some associated action upon the surrounding tissues.

The time elapsing between irradiation and the consequent reaction by the tissue cells shows that there is a latent period existing between irradiation and the appearance of visible reaction. In full skin doses from 4 to 10 days may elapse before an erythema appears. The latent period varies in different tissues and depends upon numerous inherent characteristics of the tissue irradiated as well as on the type and character of the treatment given.

With both X ray and radium we have rays of varying wave lengths. The longer the wave length, the softer and less penetrating the ray; the shorter the wave length, the harder and more penetrating the ray. In practical radiation therapy advantage is taken of this fact and, as a result, treatment is divided into superficial and deep radiation therapy.

#### SUPERFICIAL RADIATION THERAPY

X rays and radium, especially the former, have been found beneficial in more than 80 skin diseases, and the Council on Physical Therapy of the American Medical Association have approved the classification by George M. MacKee (2), from which the following has been taken:

*Group 1.*—Diseases which very often can not be permanently cured without the use of X rays or radium: Bromidrosis (localized); favus of the scalp; tinea tonsurans; chromidrosis; hyperhidrosis (localized); keloid; and rhinoscleroma.

*Group 2.*—Diseases in which irradiation is usually the most useful if not the only useful treatment: Hodgkin's disease of the skin; leukemia cutis; mycosis fungoides; sarcoma (giant cell); and Kaposi's disease.



**Group 3.**—X-ray therapy gives such excellent results that it is usually the method of election: Angioma (cavernous); blastomycosis; actinomycosis; carbuncle; granuloma annulare; sycosis vulgaris; scrofuloderma; ringworm of the beard; and plantar warts.

**Group 4.**—Diseases that may be cured or benefited by irradiation alone or by combined surgery and radiation: Basal-cell epithelioma; erythema induratum; keratosis; lupus vulgaris; sarcoid; and tuberculosis verrucosa cutis.

**Group 5.**—Diseases that can be cured or benefited by orthodox dermatologic treatment or by irradiation alone: Acne vulgaris; acne varioliformis; and common warts.

**Group 6.**—Conditions in which the Röntgen ray is often useful after other remedies have failed to effect prompt relief: Furunculosis; pityriasis rosae; and acne rosacea.

**Group 7.**—Diseases in which X-ray therapy is often of great value for the relief of annoying subjective and objective symptoms; Dermatitis exfoliativa; dermatitis venenata; eczema dermatophytosis; lichen planus; pompholyx; and psoriasis.

#### DEEP RADIATION THERAPY

According to Wood (3) "the treatment of deep-seated lesions by the Röntgen ray and radium is based on the assumption either that the cells of the tissues to be influenced are more sensitive to the radiation absorbed by them than those of the neighboring healthy tissues, or that the abnormal cells when injured repair less rapidly than the normal, or both. Unfortunately, neither of these assumptions is universally true, and the failure of deep therapy to produce a large proportion of cures in malignant tumors is primarily due to a lack of such a differential in at least a portion of the neoplastic cells, for most tumors are composed of cells of greatly varying resistance to radiation. A considerable proportion of the cells of a tumor of average sensitivity may be killed with one erythema dose, but a few cells will require for their destruction at least two or three times the dose necessary to kill the more sensitive group. From these cells of high-radiation resistance, a recurrence of the tumor may take place \* \* \*. There is still much discussion as to the stimulating power of very low doses of radiation, and the question can not as yet be regarded as finally settled. One moot point, however, has been determined, and that is that radiation of any type does not tend to 'spread' a cancer or to cause metastases."

*Practical application of deep radium and Röntgen-ray therapy.*—With the approval of the Council on Physical Therapy of the American Medical Association, Wood (3) states: "A safe general rule for the treatment of patients with malignant growths is to have only the inoperable types irradiated. But it is well to remember that in many instances, even of accessible cancer, the diagnosis is not final without a biopsy, and, before a patient with supposed carcinoma is referred for radiation treatment, the diagnosis should be completed if pos-

sible by this means." The following are among the conditions discussed by Wood that may or may not be benefited by radiation:

Basal cell tumors of the skin form an exception to the general rule of excision of all operable growths, for they may be clinically cured by radiation in about 90 per cent of the cases.

If ample radium is available (200 mg.), many surgeons now consider that results equivalent to surgery are obtainable in operable carcinoma of the cervix.

In squamous cell epithelioma, surgery is indicated if the diagnosis has been made in the early stages of growth. If it is decided to irradiate for any reason the maximum dosage consistent with skin safety should be used. If possible the regional nodes should be excised except for very small face tumors. It is not at all uncommon to see patients with enormous nodes in the neck, who have been treated with radium or X rays two or three years before, with perfect local healing.

Carcinoma of the tonsil and pharynx is so rarely operable that radiation is preferable, but seldom produces permanent cure except in the infrequent type of radiosensitive epithelioma containing lymphoid tissue.

Inoperable carcinoma of the tongue, cheek, and tonsil are best treated with radium combined with regional X ray.

In carcinoma or sarcoma of the antrum the best results have been obtained by a combination of surgery, the actual cautery for sterilization of bone surfaces, followed by radium.

Carcinoma of the larynx should be excised if possible; irradiation is unsatisfactory.

Carcinoma of the esophagus has long been treated by radium, but the results are only palliative. The dangers of causing perforation and mediastinal suppuration are great; X rays are, therefore, preferable.

Carcinoma of the rectum may be favorably influenced by combined radium and X-ray therapy. A colostomy must always be done first. Many patients are made more comfortable by X-ray treatment alone; the growth of the tumor is slowed, but the number of cures is negligible. A few patients have been cured by radium.

As a general rule cancer of the breast should be treated surgically. Even when the lesion is a border-line one, it is wiser to operate and then irradiate to prevent recurrence.

Cancer of the prostate is occasionally benefited by radium and X rays, but permanent cures are rare. The same is true of bladder tumors, although a great deal of palliative benefit can be obtained with X rays. The bleeding stops; pain is less; the urine may clear up

completely, and the patient may have comparative comfort for a year or two.

In carcinoma of the thyroid, radiation is preferable to surgery.

In all doubtful cases and in inoperable types of carcinoma of the cervix, radium combined with heavy doses of high voltage X rays should be used. Cancer of the body of the uterus, if operable, should be surgically treated, as this type of tumor is often highly resistant to radiation. With extensive secondary involvement, palliative treatment with radium plus the Röntgen ray is the only method of procedure.

Vulvar carcinomas are best treated by surgical excision of the growth and the inguinal lymph nodes. Any local recurrence may be healed by needling with radium, accompanied by heavy doses of X rays. The number of cures produced by either surgery or radiation is relatively small.

Large doses of radium or X rays have sometimes produced marked improvement in the symptoms of some gliomas.

The dural endotheliomas are obviously not sensitive, as they are mostly of a fibrous or endothelial nature.

Hypophyseal adenomas can sometimes be diminished in size and the patient freed of symptoms.

Some varieties of tumors of testicle are very sensitive and may be cured by radiation; metastases occurring before or after the primary growth has been removed are favorably influenced by radiation.

A number of the kidney tumors, including the hypernephromas and even the congenital neuroblastomas of the kidney region, are quite sensitive to radiation, but metastasis is common and records of cures are few.

Primary tumors of the lung are, in general, extremely resistant to radiation and even palliation is rarely obtained.

A striking example of the value of radium and X rays in the treatment of benign tumors is the nasopharyngeal fibroma, which is a highly vascular neoplasm filling the back of the pharynx and often penetrating into the various sinuses and distorting the face. Moderate doses of X rays or the insertion of radium needles through the nares often cause such tumors to completely disappear.

The treatment of moderate-sized fibromyomas of the uterus is extremely satisfactory. Large tumors should be removed surgically.

Intractable menorrhagias can be promptly stopped by X-ray treatment.

Regarding the radiation treatment of goiter, a certain number of cases of exophthalmic goiter may be cured. In fact, statistics are available which indicate that Röntgen irradiation in the treatment

of hyperthyroidism is successful in from 85 to 88 per cent (47 per cent exophthalmic).

Hodgkin's disease should be treated by the Röntgen ray. Life is prolonged, the patient made comfortable, and his morale is improved. The patient may even be able to work for a long time, but permanent cures do not result.

The leukemias may also be treated by X rays with much more convenience than with radium, and in the myelogenous types benefit is obtained and life prolonged. Chronic lymphatic types do not often yield, although occasionally a favorable case is encountered. The acute forms should not be irradiated, as nothing is gained by treatment.

A combination of benzene and irradiation is the best treatment for polycythemia, often producing remissions over a long period of time. The bone marrow but not the spleen should be given moderate exposures, frequently repeated.

Hypertrophied tonsils when not accompanied by peritonsillar infection can often be benefited by radiation. The tonsils shrink and the child does not suffer from as many infections as usual. Radiation is also indicated in cases where surgery is contraindicated. Lymphoid nodules in the pharynx and adenoid tissue can be cleaned up successfully by two or three fractional doses of X rays; a second course of treatment is seldom necessary.

*Radiation Therapy in Bone Tumors.*—Geschickter (4) gives a most complete study of the Röntgenologic diagnosis and classification of bone tumors. He suggests that deep X-ray therapy is helpful in the following conditions: Benign bone cysts; giant-cell tumor; chondroma; single metastatic tumor; Ewing's sarcoma; Garre's osteitis; fibrosarcoma; ossifying periostitis; metastatic carcinoma (spine, pelvis, and femur).

He also states that "radium therapy is helpful in osteogenic sarcoma". This group is divided into osteoblastic and chondral types, and mention is made of the use of radium in the chondral type. Radium may also be useful in myxosarcoma.

*Palliative treatment with the Röntgen ray.*—In discussing this field Wood (3) states:

There is one phase of irradiation which is too often forgotten, and that is the purely palliative aspect of treatment with the X rays \* \* \* It includes postoperative radiation of carcinomas of the breast in which a certain percentage of patients are unquestionably benefited and their lives prolonged in comfort, and pulmonary metastasis from tumors of various types where it often relieves the patient and prolongs life \* \* \* The pain and disability resulting from bone metastases, even extensive spinal and pelvic lesions following unsuccessful surgical removal of the breast, may often be relieved \* \* \* Papillary ovarian carcinomas, even when there is considerable abdominal involvement, may some-

times be held in check for a long period with moderate doses of the Röntgen ray.

\* \* \* There are always patients whose tumors resist irradiation completely, but there are many others whose growths seem to be very susceptible and obtain the greatest benefit, though ultimately they die of the disease \* \* \* Too often the patient is rendered worse by the production of skin injuries, fat necrosis, or extreme anemia in the attempt to destroy a growth which is highly insensitive to radiation. Very feeble, nervous patients or those with advanced cachexia should not be irradiated. The patients' lives may be shortened by such treatment.

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#### CASE DURATION

By LENA WILLIGE, Section of Vital Statistics, Bureau of Medicine and Surgery, Navy Department

Vital statistics are relatively valuable only in direct proportion to the accuracy of the basic data from which they are compiled. This fact should be kept in mind when writing the individual medical histories—the foundation of our system of compilation of vital statistics. These statistics are of indispensable value to our own service as a basis for preventive measures in safeguarding the health of the United States Navy and Marine Corps, and in eliminating in so far as possible the causes of injuries. They are also in demand by other governmental agencies and insurance companies for actuarial and other study. Data from the table showing distribution of diseases and injuries among occupational groups of the personnel are incorporated in a textbook, Occupational Health, edited by Kober and Hayhurst.

Table No. 1 of the annual report of the Surgeon General is a detailed statement of diseases and injuries (p. 208 in 1931 report), and has a column of sick days indicating the number recorded for each diagnosis during the year. Table No. 2 is a distribution of diseases and injuries among the occupational groups (p. 241 in 1931 report), and has a column of sick days indicating the number recorded for each one of the 27 classes of diseases and injuries. There is also a column indicating the noneffective rates, showing the rate per thousand of patients constantly on the sick list for each class.

These rates are based upon the "daily average of patients," which is obtained by dividing the number of sick days by the number of year days. When patients are carried a greater number of days than required for the treatment and convalescence of the disability concerned these rates are distorted.

*Examples.*—Case reports have been received in the bureau indicating that patients have been on the sick list with acute bronchitis, 112 days; acute tonsillitis, 95 days; many cases of acute catarrhal fever, 30, 40, 50, 60, and even more than 70 days; German measles, 53 days; measles, 105 days; mumps, 53 days; acute gastroenteritis, 95 days; scarlet fever, 77 days; redundant prepuce, 123 days; caries of teeth, 230 days; chicken pox, 71 days. Obviously, the number of days on the sick list is out of proportion to the gravity of the disability. A review of the records of these cases shows that the error can frequently be traced to the failure to note changes of diagnoses in the medical-history sheets at the proper time or a lack of contact between the medical wards and the record office.

The Form F cards prepared by the record office should agree in every detail with respect to diagnoses and changes of diagnoses with the medical-history sheets. Even though a most careful check is made at this point, if the cases are not correctly written up, the Form F cards will still be in error, and it is from the Form F cards that the major statistics published in the annual report of the Surgeon General are compiled. At least one of our hospitals has instituted the practice of requiring medical officers in charge of wards to report to the executive officer every week that all health records have been inspected with a view to timely changes in diagnoses.

*"Admitted contributory disability."*—Among the designations used in recording admissions to the sick list is "admitted contributory disability," "ACD," for reporting complications, sequels, disabilities resulting from treatment of and disabilities incident to a primary disability. With this designation it is possible to give a very logical and complete presentation of a case, and in order to have our statistics uniform it should always be used when the occasion demands. An attack of bronchitis can hardly be considered in the acute stage for 112 days. If no definite complication arises, the bronchitis will at least assume the chronic form. For example, after referring the case cited to the medical officer concerned, it was adjusted to acute bronchitis, 35 days, and chronic bronchitis as a sequel, "ACD," 77 days. Hence instead of 112 days being charged to acute bronchitis in table No. 1, and charged to Class VIII—communicable diseases transmissible by oral and nasal discharges—in table No. 2, 77 days were charged where they rightly belong, to chronic bronchitis, Class XVIII—diseases of respiratory system. A

case of acute tonsillitis was carried 48 days. The medical history sheets showed the acute attack had completely subsided in 18 days, but since the tonsils were of the hypertrophied type, they were removed, the operation for which, in all probability, would not have been performed while in the acute state, and yet no change in diagnosis was made. Adjusted, the case stood acute tonsillitis, 18 days, and chronic tonsillitis as a sequel, 30 days, the 30 days being taken from Class VIII and charged to Class V—diseases of ear, nose, and throat. Investigation of a case of mumps carried 49 days, disclosed a complication of orchitis. The case was finally disposed of with a charge of 12 days to mumps and 37 days to acute orchitis as a complication. This exemplifies the real value of using the designation of "admitted contributory disability," since it is of statistical value to know the percentage of mump cases developing orchitis. A case of measles, 105 days, was adjusted to measles, 25 days, changed to acute bronchitis as a complication, 27 days, and chronic bronchitis as a sequel, 53 days. Acute catarrhal fever, 62 days, was adjusted to acute catarrhal fever, 10 days, and acute otitis media as a complication, 52 days. Caries of teeth, 230 days, was adjusted to caries of teeth, 59 days, and absence, acquired, teeth, as a sequel, 171 days. German measles, 53 days, was adjusted to German measles, 16 days, and acute bronchitis as a complication, 37 days. Request for a review of a case of scarlet fever, 77 days, disclosed the fact that there had been an urticaria from serum reaction, so adjustment was made to scarlet fever, 46 days, and 31 days to serum sickness as a sequel.

In many cases a complication or sequel is noted but the date of change of diagnosis is so delayed that the distribution of sick days is again out of proportion. A case was reported under chronic tonsillitis, 92 days, and changed to rheumatic fever as a sequel, 14 days, whereas the rheumatic fever was apparent at the first stage of the illness. Adjusted, chronic tonsillitis reported 19 days and rheumatic fever 87 days. A case with an intercurrent diagnosis reported acute catarrhal fever, 65 days, changed to gonococcus infection, urethra, 44 days. An entry in health record indicated that a positive smear for the gonococcus was obtained on January 2, 1931, yet the change of diagnosis was postponed until March 2, 1931. In this case acute catarrhal fever was actually responsible for only 6 days, while the remaining 103 days were chargeable to the gonococcus infection.

*Change of diagnosis in case of concurrent disability.*—Patients having a disability of long duration often develop a concurrent disease or condition to which the diagnosis is changed. Frequently these cases are carried under the latter diagnosis until patient is discharged to duty, whereas in fact the second disability has long

since subsided and it is the first disability which is causing the retention of the patient on the sick list. A case of chronic arthritis was changed to chronic tonsillitis and carried 69 days. The tonsils were removed and patient had entirely recovered from the operation in 15 days, but as the arthritis was still present, the diagnosis should have been changed to the arthritis for the remaining 54 days. A compound fracture of ulna was changed to a concurrent acute tonsillitis and carried 79 days. Upon reviewing the case, it was found that the tonsillitis lasted but four days, in view of which the diagnosis was changed to the fracture for the remaining 75 days.

*"Diagnosis undetermined."*—This is a title used for reporting an evident disability which can not be immediately diagnosed and should be used to note a change of diagnosis when a second disability is apparent instead of continuing a patient under the disability from which he has recovered until the second disability can be definitely determined. For example, a case was carried under redundant prepuce for 123 days. A notation in medical-history sheets on the fifth day showed that there was surgical interference and an uneventful recovery, but the patient developed pains in his knees. The diagnosis in this case was not changed from redundant prepuce to chronic arthritis, knees, until 118 days later. It is possible that the condition could not be immediately identified as arthritis and the change therefore made previously, but it should have been made on the fifth day to "diagnosis undetermined (joint condition)" and diagnosis changed to the arthritis on the date that the disability was definitely determined. In adjusting this case for statistical purposes, the bureau carries the arthritis back to the admission under the "diagnosis undetermined," and the sick days are thereby properly apportioned to their respective classes.

*"No disease."*—This is a title used to report cases of individuals who have been in contact with a communicable disease and those who are under observation for a suspected disability. This title should be resorted to instead of continuing a patient under a definite diagnosis when that diagnosis no longer applies. The total sick days may remain the same, but by changing the diagnosis to "no disease" whenever it is found necessary to retain patients on the sick list beyond recuperation period, the corresponding sick days are recorded in Class XXI—miscellaneous diseases and conditions—instead of unduly inflating a definite class of diseases. To illustrate, a case of measles was carried 72 days. As a matter of fact, for the last 41 days of this period, the patient was under observation for a mental condition. In such cases the diagnosis should be changed to an intercurrent "no disease," which would be changed on account of error when observation reveals a definite disability. If no disability is



revealed, the patient would be discharged to duty under the title "no disease" with the suspected disability stated. A case of German measles, 50 days, was corrected to German measles, 22 days, and no disease (awaiting ship), 28 days. Measles, 46 days, was corrected to measles, 22 days, and no disease (held for pay accounts), 24 days. Mumps, 55 days, was corrected to mumps, 23 days, and no disease (rations), 32 days. Mumps, 58 days, was corrected to mumps, 25 days, and no disease (awaiting disciplinary action), 33 days. All admissions for "no disease," other than those under observation for a disability or in contact with a contagious disease, are changed to readmissions in the bureau because they are not considered bona fide admissions to the sick list and are not counted in the rates of admission. However, this does not eliminate the damaging increase to the noneffective rates through the additional sick days. It is to the best interest of the service to avoid holding patients who have recovered from their disabilities. It would be a better solution to discharge them to duty to the receiving ship to await such time as they can join their commands.

*When two or more diseases coexist.*—During the year 1930, 277 venereal cases reported an intercurrent redundant prepuce. Only 29 cases of redundant prepuce were carried less than 10 days, while in 138 cases reported, the sick days varied from 25 to 83 days per case, making a total of 7,662 sick days. Not only does this practice vitiate our statistics through a wrong distribution of sick days but it disregards the law governing loss of time and pay in venereal cases. To correct this condition, it became necessary to advise the service by means of a circular letter, No. 521, 1931, to observe the provisions of paragraph 2401 (e), Manual of the Medical Department, reference which directs that "when two or more morbid entities exist preference shall be given the graver affection." In the bureau's opinion, redundant prepuce is a minor affection, and should therefore be reported for record only in cases where venereal disease is coexistent.

*Influence of disease duration on noneffective rates.*—The admission rates show the prevalence of the diseases and injuries, but it is the noneffective rates which indicate the real damage to the service. If there were 1,000 admissions for acute catarrhal fever, reporting 3,000 sick days, or 1,000 admissions, reporting 10,000 sick days, in either case the admission rate would be the same, but the greater damage is in the larger number of sick days. So if the sick days of one group are unduly inflated, a disproportionate number of sick days would occur in another group. The result of this situation would be that correlations based upon a study of the basic statistical data would be inaccurate. It must also be borne in mind that other governmental departments and agencies, insurance companies, and

boards of health have constant recourse to our statistical tables, and if the noneffective rates are higher than warranted the service suffers by comparison in those particular classes of diseases in which inflation occurs.

Cases are constantly reported to the bureau with an evident inflation of sick days. Of course these are returned to the activities for review and necessary correction. There are, however, border-line cases in which it is not possible to judge at what point the sick days become questionable. It is this group of cases which requires the constant attention and the best judgment of the medical officers. In order to obtain reliable vital statistics, the greatest accuracy and cooperation are essential. A breakdown anywhere along the line is reflected adversely in the statistical tables and charts which appear in the annual report of the Surgeon General.

## CLINICAL NOTES

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### TUMOR OF THE PITUITARY BODY WITH POSITIVE ASCHHEIM-ZONDEK TEST

#### REPORT OF CASE

By JULIAN LOVE, Lieutenant (Junior Grade), Medical Corps, United States Navy

Enlargement of the anterior hypophysis in pregnant women at post-mortem was observed by Launois and Maulon (1) in 1904. However, it was not until 1928 that practical application of this knowledge was made—the Aschheim-Zondek test for pregnancy.

Aschheim and Zondek (2) demonstrated the presence of the anterior pituitary sex hormone in the urine of pregnant women by injecting the urine into immature female mice, producing in these animals changes in the ovaries and uterus.

The case reported is that of a pituitary tumor in a male in which the Aschheim-Zondek was of assistance in definitely localizing the lesion. The test in this case showed the urine to contain 31,000 mouse units—three times as strongly positive as a normal pregnant woman's urine.

#### CASE REPORT

J. J. B., male, age, 38; admitted to the United States Naval Hospital, New York, on February 5, 1931, complaining of failing vision and severe headaches.

*Present illness.*—About a year ago he noticed that "something was wrong with his eyes." "In looking at objects they would seem to disappear." Glasses prescribed gave relief for a few weeks. Later developed "buzzing noises" in the right ear and headaches. Admitted to a civilian hospital, where an examination including an X-ray study and spinal fluid examination was made. The results of the examination were apparently inconclusive.

*Family history.*—Negative.

*Past history.*—Negative. Venereal diseases denied.

*Physical examination.*—Showed only a fixed right pupil to light and distance and an inability to see with this eye. It was noted that he walked carefully because of poor vision. Complete physical and neuropsychiatric examination was otherwise negative. Urinalysis and Kahn tests were negative.

*Special eye examination.*—There was no light perception of the right eye, while the left had 12/20 vision; the fundi showed optic neuritis. The lens and media were hazy. The arteries were very small and tortuous; veins dilated; and disk edges blurred with an exudate.

*Lumbar puncture.*—Spinal fluid under tension (50 mm. of Hg). Thirty c. c. of fluid were removed and the tension dropped to normal. This gave the

patient complete relief from his previous severe headaches. Examination of the spinal fluid was negative.

*X ray.*—The sella turcica showed a very large sella with marked absorption of the posterior clinoid process with no erosion but marked depression of the floor. Findings: Hypophyseal tumor.

February 27, 1931: A morning specimen of urine was sent to Memorial Hospital, New York City, where, through the courtesy of Dr. Russell Ferguson, an Aschheim-Zondek test was performed and found to be three times as strongly positive as that of a normal pregnant woman.

The patient was given deep X-ray therapy. At first, because there was no return of the patient's headaches, no decrease in visual fields, and a gradual decrease in the strength of the Aschheim-Zondek test to negative, it was felt that the patient was improving. Later it was found that the patient's blindness was gradually increasing and it was found that X ray *per se* (3) destroys the anterior pituitary hormone.

June 18, 1931: The patient was transferred to the U. S. Veterans' Bureau Hospital 81. Just prior to discharge, an X ray of the sella turcica showed no further changes.

*Clinical Diagnosis.*—Adenoma of the anterior lobe of the pituitary body.

#### COMMENTS

With the symptomatology definitely pointing to a tumor of the brain in the hypophyseal area, X-ray findings of an enlarged sella turcica with erosion of the clinoid processes and depression of the floor, the markedly increased tension of the spinal fluid, and relief of headaches after drainage of 3 c. c., it was felt that in view of the so strongly positive Aschheim-Zondek test, localization of the tumor in the anterior lobe was justified.

It was interesting to find that the Aschheim-Zondek test in this case was three times as strong as that normally expected in the urine of a pregnant woman. It has been noted that abnormal pregnancies (e. g., tubal, abdominal, etc.), hydatiform moles and chorioepitheliomata, yield urines whose strength in anterior pituitary mouse units is much higher than normal.

In addition to the lesion reported, a positive Aschheim-Zondek test may occur in males with teratomata of the testicle (4), probably due to the development of these trigeminal growths affecting the pituitary body in a manner similar to that of a normally developing embryo.

#### CONCLUSIONS

1. A case of a hypophyseal tumor in a male with a strongly positive Aschheim-Zondek test is reported.
2. Localization of the tumor in the anterior pituitary lobe was made on the finding of the anterior pituitary sex hormone in the urine.

3. This case suggests a biological means of localization of tumors of the pituitary body.

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#### ACUTE HEMORRHAGIC PANCREATITIS OCCURRING DURING GENERAL ANESTHESIA: PRELIMINARY NOTICE <sup>1</sup>

By O. WILDMAN, Lieutenant Commander, Medical Corps, United States Navy

During the past three years three cases dying under general anesthesia in which the tissues from autopsy showed acute hemorrhagic necrosis of the pancreas (acute hemorrhagic pancreatitis) of extreme degree as the cause of death, have come to my attention as pathologist at the United States Naval Medical School.

The operations and anesthetics used were as follows: Exploratory laparotomy under ethylene; incision of submaxillary abscess under ether; and operation on draining sinus from rib under nitrous oxide-oxygen anesthesia.

None of these patients showed any symptoms referable to the pancreas prior to the anesthesia. No gallstones or other obstructions in the bile ducts were found at autopsy.

It seems probable that in the course of the anesthesia duodenal contents or irritating bile regurgitated into the pancreas, activating the pancreatic ferments. Rapid digestion of the pancreas resulted and the patient was overwhelmed by poisonous split-protein products and shock.

In order to possibly clear up the mechanism responsible for these unusual catastrophes, it is urged that medical officers in all cases of acute hemorrhagic pancreatitis coming to autopsy thoroughly investigate for any anomalies in the bile ducts, pancreatic duct, accessory pancreatic duct, and duct sphincters.

If autopsy material is submitted to the Naval Medical School it is suggested that it include the intact pancreas, duodenum, common and cystic bile ducts, and gall bladder.

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<sup>1</sup> Received for publication Jan. 12, 1932. Read at the staff conference of Naval Medical School and Washington Naval Hospital, U. S. Naval Medical School, Washington, D. C., Jan. 15, 1932.

## SUMMARY

Three cases of death on the table under general anesthesia are reported in which autopsies showed acute hemorrhagic pancreatitis as the cause of death.

Further observations are needed on cases of acute hemorrhagic pancreatitis coming to autopsy to determine the anatomical relations of the duct system.

## SCHÖNLEIN-HENOCH DISEASE

## REPORT OF A CASE

By L. R. NEWHOUSE, Lieutenant, Medical Corps, United States Navy

Schönlein-Henoch disease is a condition of undetermined etiology in which purpura and various cutaneous lesions of the erythema group occur, along with arthritic symptoms and abdominal colic. The blood findings are usually normal except for leucocytosis, although frequently there is anemia and a lowered calcium content.

Formerly, cases in which joint symptoms predominated were called Schönlein's disease or purpura rheumatica, while those in which severe abdominal colic occurred were called Henoch's purpura. Recently, however, it was recognized that these were different types of the same disease.

The disease is variable in onset and may be ushered in by any of the following symptoms: Anorexia, nausea, prostration, purpuric outbreak, abdominal colic, or joint pain with or without swelling. The rash is frequently confined to the extensor surfaces of the legs. Purpura or the erythematous group of skin lesions may occur before or long after the arthritic symptoms and abdominal crisis. Death may occur from kidney disturbances.

## CASE REPORT

F. N. K., age 20, admitted to the United States naval hospital, Annapolis, Md., on November 23, 1930, with nausea, vomiting, severe abdominal pain, and a purpuric rash on ankles, legs, and forearms. Four days prior to admission the patient became chilled and noticed purpuric spots in the region of the left ankle. The lesions caused no itching and the patient stated that he did not feel ill. The following morning had colicky abdominal pain accompanied by diarrhea. The purpura spread over the legs and forearms. The day prior to admission to the hospital, however, aside from the purpura, there were no other symptoms.

*Past history.*—General health good except for broncho pneumonia in 1928 and a severe bronchitis in 1930 which was followed by a cough lasting two months.

*Family history.*—Essentially negative.

*Physical examination.*—A well-nourished and well-developed young adult male. Numerous purpuric lesions, varying from 1 to 8 millimeters in diameter

over ankles, antero-lateral aspect of the legs, forearms and especially in the region of the elbows and a few over the buttocks. Generalized abdominal tenderness with slight gaseous distention. Blood pressure 120/80, temperature 100° F., pulse 80, and respiration 20. Urinalysis, negative. Red blood count 3,940,000; hemoglobin, 80 per cent; leucocytes, 8,800; neutrophils, 70; lymphocytes, 26; mononuclears, 8; eosinophiles, 1.

During the first 24 hours after admission he complained of a moderately severe colicky abdominal pain. The temperature ranged from normal to 99° F. The blood picture was the same as on admission. Bleeding time, 2 minutes and 40 seconds. Coagulation time, 3 minutes and 15 seconds.

November 25: Complained of severe colicky abdominal pain, nauseated and vomited normal gastric contents on two occasions. Passed three partially formed stools, positive for occult blood. Eye-ground examination negative. Red blood cells, 4,270,000; hemoglobin, 85 per cent; leucocytes, 13,900; neutrophils, 78; lymphocytes, 21; mononuclears, 1; blood platelets, 325,000; coagulation time, 3 minutes and 30 seconds.

November 26: Patient had severe abdominal pain, requiring morphine for relief. Complained of pain in the ankles and left ankle was moderately swollen in the region of the external malleolus. The purpuric lesions were larger and extended over the ankles, legs, buttocks, back, and forearms. Four semi-formed stools were passed containing decomposed blood. Temperature ranged from 98° to 100° F., pulse 55 to 70, respiration 20.

November 27: Restless, irritable, nauseated at times and had severe abdominal pain. Passed six small, foul, semiliquid stools, all positive for occult blood. The pain in the ankles subsided, but swelling in the region of the left external malleolus persisted. Blood pressure 120/80.

November 28: Severe colicky abdominal pain requiring the use of morphine. Moderate gaseous distention, passed considerable flatus and one stool, positive for blood. Blood pressure 120/76, temperature 98° to 100.2° F., pulse 70 to 100, respiration 22.

November 29: During the morning the patient was restless, irritable, and had slight abdominal discomfort. Passed one semiformed stool. In the afternoon had severe abdominal pain, gaseous distension, and passed large amounts of flatus. Urinalysis, specific gravity 1.024, three plus albumin, many coarse granular casts, numerous red blood cells. Red blood count 4,500,000; leucocytes, 37,700; neutrophils, 90; lymphocytes, 10.

November 30: Early in the morning the patient became very restless, pulse increased from 110 to 160, thready and irregular, extremities cold, temperature subnormal, thirsty, respirations 25, slight air hunger. During the forenoon his general condition was fair. Blood pressure 110/80, temperature 100° F., pulse 120, respiration 20. In the afternoon he again complained of abdominal pain. Urinalysis, specific gravity 1.020, three plus albumin, many coarse granular casts. In the evening the blood pressure was 164/90. Red blood count, 4,500,000; hemoglobin, 83 per cent; leucocytes, 17,300; neutrophils, 83; lymphocytes, 17; blood platelets, 315,000 (average of three counts); blood, Kahn test, negative.

December 1: General condition fair, rested well except for an occasional attack of abdominal pain. He passed three small, foul, tarry stools. Blood pressure 144/80. Urinalysis essentially same as the preceding day. Culture of feces negative.

December 2: General condition improved. Blood pressure 140/80. Temperature 99 to 101° F., pulse 110 to 120, respirations 20, the purpuric lesions increasing. Urinalysis, specific gravity 1.022, albumin four plus, negative for

sugar, numerous red cells, many coarse granular casts. Blood chemistry showed nonprotein nitrogen 64, urea nitrogen 37.5, uric acid 6.6, sugar 72, and calcium 4 milligrams per 100 cubic centimeters of whole blood.

December 3: Patient was very restless and irritable, had an occasional attack of abdominal colic. Considerable increase in the purpuric lesions during the past 24 hours. The pulse rate was increased from 110 to 120 for about one hour. Three semiliquid, tarry stools were passed during the day. Blood cultures negative.

December 4: During the early morning the patient was talkative and slightly irrational. Blood pressure 110/76, temperature normal, pulse ranged from 120 to 155. Five hundred cubic centimeters of 5 per cent glucose solution was administered intravenously. Following this his condition improved. Later, however, he became restless, irrational, had several bowel movements consisting of fresh and decomposed blood. Purpura extended over arms, legs, thighs, trunk, and neck. Pulse had become rapid and thready. Delirium developed and a large quantity of bright red blood was passed by rectum. The patient died about 10 minutes later. Permission was granted for a post-mortem examination of the abdomen.

#### POST-MORTEM FINDINGS

*General appearance.*—The body showed evidence of recent loss of weight. There were purpuric lesions over the entire body except the face, but more pronounced on the extremities. The lesions varied from 1 millimeter to 4 centimeters in diameter.

*Stomach.*—Negative.

*Small intestine.*—Beginning at the pyloric ring, the entire small intestine was markedly congested, edematous, and distended. The duodenum and jejunum showed marked congestion of the mucosa, and there were numerous scattered areas of denudation, necrosis, and sloughing, varying from 0.5 to 1 centimeter in diameter. The remainder of the small intestine showed the same pathology except in the terminal ileum, where the areas of necrosis were much larger—1 to 3 centimeters in diameter. Almost the entire terminal ileum was covered with friable blood clots.

*Large intestine.*—The entire colon showed marked congestion. There were large hemorrhagic areas in the mucosa and areas of denudation and necrosis extending down to the muscularis. In the transverse colon there was one area of necrosis 15 centimeters long and about 7 centimeters wide. The mesenteric lymph glands were enlarged.

*Liver.*—Essentially negative.

*Gall bladder.*—Distended with thick tarry contents.

*Pancreas.*—Negative.

*Spleen.*—Very friable, otherwise negative.

*Kidneys.*—Normal in size but markedly congested with hemorrhagic areas through the pyramidal tracts.

*Urinary bladder.*—Several hemorrhagic areas noted over the peritoneal surface.

*Peritoneum.*—Several scattered purpuric lesions were noted over the parietal surface.

The following histopathological report was furnished by Lieut. Commander Otis Wildman, Medical Corps, United States Navy, United States Naval Medical School, Washington, D. C.:

*Liver.*—The polygonal cells are moderately swollen and granular. There is some central necrosis and the liver cells in these areas contain bile pigment.



The gall bladder shows disintegration of the mucosal epithelium, leaving only the stroma, which is deeply bile stained. The muscularis is somewhat degenerated.

*Pancreas*.—Normal.

*Spleen*.—The sinusoids are distended with blood. The reticulum and a fair number of eosinophiles are scattered through the pulp.

*Kidneys*.—The tubular epithelium is swollen and markedly granular. The blood vessels are congested, especially in the region of the straight tubules in the medulla, where the hemorrhage has occurred in the tubules.

*Abdominal lymph nodes*.—Markedly edematous and numerous eosinophiles noted.

*Intestines*.—Sections from various portions of the small and large intestines show similar pathology, but varying in degree, particularly noticeable in the lower ileum. Here there is extreme necrosis and sloughing of the mucosa. The slough in places extending down to the muscularis. The patches of mucosa which remain are markedly degenerated, with loss of lining epithelium. Edema is marked and areas of degenerated extravasated blood are noted. The large veins in the submucosa show marked degeneration of the walls and their lumina are filled with necrotic thrombi. Both muscular layers are markedly degenerated or necrotic and very edematous. There is considerable cellular infiltration throughout the wall, made up of lymphocytes, macrophages, and plasma cells with a fair number of eosinophiles.

#### COMMENTS

1. Several theories have been advanced as to the etiology, but to date none have been proved. The theory that the disease is an anaphylactoid disorder has the greatest amount of support.

2. Frequently there is difficulty in arriving at a diagnosis because of the variability of the onset and symptoms.

3. These cases have at times been operated upon on account of simulating an acute surgical condition of the abdomen and in rare instances intussusception and intestinal obstruction does occur.

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## ACUTE LYMPHATIC LEUKEMIA

## REPORT OF CASE

By B. N. AHL, Lieutenant (Junior Grade), Medical Corps, United States Navy

This case is reported for two reasons: First, acute lymphatic leukemia is sufficiently rare to be of general interest; and, second, the rapidity with which the disease in this case developed and ran its course.

## CASE REPORT

A. R., mess attendant, third class, age 22, was admitted to the sick bay of the U. S. S. *Arkansas* on May 31, 1931, complaining of fever, sore throat and difficulty of swallowing. Duration—24 hours: Temperature, 99.8° F.; pulse, 76; and respiration, 22.

*Past history.*—Yaws during childhood, otherwise negative.

*Family history.*—Unsatisfactory.

*Physical examination.*—A well-developed Filipino male. Does not appear very ill.

*Head.*—Eyes slightly injected, react to both light and accommodation. Pupils equal. Slight discharge from nose. Ears normal. Throat injected, tonsils hypertrophied and inflamed. Gums turgid and swollen. Smear of gums and throat positive for fusiform bacilli and spirilla.

*Neck.*—Slight adenopathy of sublingual and anterior cervical lymph nodes.

*Lungs.*—Normal.

*Heart.*—Normal. Blood pressure: Systolic, 120; diastolic, 82.

*Abdomen.*—Normal.

*Genitalia.*—Normal.

*Reflexes.*—Sluggish.

*Skin.*—Moist. No discolorations. No adenopathy noted except that mentioned previously.

June 1: Temperature, 100.2° F.; pulse, 86; respiration, 22. No improvement.

June 3. Temperature, 101° F.; pulse, 88; respiration, 22. No improvement. Sublingual and cervical glands enlarged. Patient has difficulty in swallowing. No membrane on throat.

June 5: Temperature, 102° F.; pulse, 100; respiration, 24. Smear again positive for Vincent's organism. Adenopathy of the neck more pronounced, slight generalized adenopathy. Throat swollen and dull red in color. Patient worse.

June 6: Temperature, 103° F.; pulse, 110; respiration, 22. Examination reveals a generalized lymphadenopathy.

June 8: Temperature, 103.6° F.; pulse, 110; respiration, 26. Patient is toxic and appears anemic. Red blood count, 3,500,000; white blood count, 34,500; small lymphocytes, 95; eosinophiles, 2. Chest clear throughout. There is a definite generalized lymphadenopathy, bleeding from the gums, and a very foul breath. Spleen and liver slightly enlarged. Kahn, 4 plus.

June 9: Temperature, 103° F.; pulse, 130; respiration, 24. Patient decidedly worse. Red blood count, 2,440,000; white blood count, 80,000; small lymphocytes, 98 per cent.

June 10: Temperature, 103.6° F.; pulse, 145, respiration, 24. Patient growing weaker. Adenopathy of neck marked, breathing labored. Red blood count, 2,150,000; marked decrease in blood platelets; white blood count, 115,000; small lymphocytes, 98 per cent.

June 11: Temperature, 103° F.; pulse, 150; respiration, 24. Patient dull and listless; answers questions but with difficulty. Semistuporous most of the time. Red blood count, 2,000,000; white blood count, 128,000, practically all of which are small lymphocytes.

June 12: Temperature, 101° F.; pulse, 155; respiration, 20. Patient semi-conscious, tosses around continually. Two moderate hemorrhages from the bowel. Several discolored areas on body (subcutaneous hemorrhage). Subconjunctival hemorrhages of both eyes. Red blood count, 2,000,000; white blood count, 192,000; small lymphocytes, 99.

June 13: Temperature, 99.2° F.; pulse, 160; respiration, 30. Patient unconscious. Red blood count, 1,332,000; white blood count, 256,000. The coma terminated in death.

*Clinical diagnosis.*—Acute lymphatic leukemia.

#### AUTOPSY REPORT

The body that of an adult, male Filipino, approximately 23 years of age. Weight about 100 pounds. The skin is smooth, dry, and pale. There is post-mortem mottling on the dorsal surface of the body and around the neck. On the right side of the abdomen there are several petechial hemorrhages about 2 millimeters in diameter. There is a generalized lymphadenopathy and several scars over the body, no scars of any size, and no evidence of violence. Rigor mortis present.

*Head.*—Ears negative. Pupils equal and dilated. Conjunctiva of both eyes, red and hemorrhagic. Nose negative. Mouth is foul and of a reddish-brown color. The entire pharynx is swollen and there are several necrotic areas around the gum margin. The sublingual, anterior, and posterior cervical lymph glands are very large and discrete.

*Chest.*—Both lungs are normal in size, color, and consistency, except the lower dorsal surfaces, which are slightly hemorrhagic. The thoracic lymph nodes are all markedly enlarged, especially around both hila. The trachea is not obstructed at any point. The heart is enlarged and somewhat flabby. Distributed over the ventral surface of the right ventricle are numerous small subpericardial hemorrhages. The right auricle is dilated and the auriculo-ventricular valve admits four fingers easily. The coronaries are patent and normal.

*Abdomen.*—The liver is markedly enlarged and extends four fingers' breadth below the last rib. It is paler than usual and is rather greasy to the touch. On section it has a mottled appearance. The capsule is normal. The gall bladder is normal. The spleen is twice normal size and is bound to the diaphragm, liver, and abdominal wall by recent adhesions. It is pale in color. The capsule is normal. On section it is seen to be engorged. Stomach is normal. The kidneys are larger than normal, pale in color, capsule strips readily, and on section, except for pale color, presents a normal appearance. The intestines are pale in color and the mesentery is full of enlarged lymph nodes. The lower 12 inches of the large bowel is acutely inflamed and hemorrhagic.

*HISTOPATHOLOGICAL EXAMINATION: Bone marrow.*—A diffuse proliferation of immature lymphocytes has largely replaced the normal myeloid elements. Mitotic figures are numerous.

*Lungs.*—Alveolar walls are infiltrated with immature lymphocytes which in scattered areas form large masses. Alveoli contain large numbers of red blood cells in one section, in the other the lung is emphysematous. Blood in the lumen of veins shows enormous numbers of immature lymphocytes.

*Heart.*—Muscle fibers are broad, somewhat granular, take a pale stain, and are fragmented. Small, scattered collections of immature lymphocytes are present in the epicardium and between the muscle fibers.

*Liver.*—Interlobular fibrous tissue is replaced by proliferating lymphocytes. Polygonal cells are granular, fatty, and indistinct in outline.

*Spleen.*—Normal pulp and Malpighian architecture is replaced by proliferating immature lymphocytes.

*Lymph node.*—Normal architecture is replaced by a diffuse proliferation of immature lymphocytes. Capsule is not invaded.

*Kidneys.*—Bowman's capsular space contains a serous exudate. Tubular epithelium is swollen and granular. Interstitial tissue is infiltrated with immature lymphocytes.

*Blood slides.*—Approximately 95 per cent of the white blood cells are lymphocytes, the majority of which are of the *blast* type. An occasional neutrophile and eosinophile is present. Platelets are greatly diminished. The red blood cells show achromia, polychromatophilia, and an occasional normoblast is noted.

*Pathological diagnosis.*—Lymphatic leukemia, acute.

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#### A SIMPLE COLORIMETRIC METHOD FOR THE DETERMINATION OF POTASSIUM IODIDE IN THE BLOOD AND URINE<sup>1</sup>

By H. W. PATTON, Lieutenant, Medical Corps, United States Navy

The administration of relatively large doses of potassium iodide over extended periods of time, particularly in the treatment of syphilis, is a fairly common procedure. Most patients excrete this drug readily—chiefly through the kidneys—and no ill effects are noted, but occasionally we are confronted with a patient who retains iodides to such a degree that there is danger of iodism if the usual dosage is administered.

Since the clinical effects produced are due to the degree of concentration of the iodide ion in the tissues, it becomes obvious that in patients with an impaired iodide excretion, small doses will achieve the same results as will larger doses in normal individuals. A simple method, therefore, of determining the excretory powers of the kidney for iodides would seem to offer a definite aid to the clinician desirous of employing iodide therapy.

The first requirement of such a method is that it be a simple but fairly accurate quantitative estimation of the iodide content of the blood and urine.

The method described herein requires no laboratory equipment or reagents other than those usually available on board ship and is sufficiently accurate for clinical purposes. More accurate but complicated methods have been described by Yoshimatsu and Sakurada

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<sup>1</sup> Primarily this is a test for iodine, and therefore is equally applicable to all substances liberating free iodine. The table of standards given in the article represents iodine expressed as potassium iodide. In testing for other iodides the factor representing the difference in the ratio of iodine would have to be taken into consideration.

(1), and by Leitch and Henderson (2), but such a degree of accuracy is not ordinarily required.

As early as 1867 Duckworth recognized the fact that iodide excretion was dependent upon kidney function and attempted to devise a satisfactory renal functional test dependent upon the rate of excretion of standard doses of potassium iodide.

In 1913 Rowntree and Fitz (3) made extensive clinical and experimental studies in this field and abandoned the iodide test as less valuable than phenolsulphonphthalein.

All workers seem to agree that iodide excretion is hindered chiefly by the lesions of the uriniferous tubules. It is in such patients, particularly, that preliminary excretory functional studies should precede heavy iodide administration. In one case of chronic interstitial nephritis recently observed by the author demonstrable quantities of iodide were found in the blood after administration of only 25 grains of potassium iodide daily for three days. In other patients without renal lesions no iodides were demonstrable in the blood by the same test, although the daily dosage was 80 grains and had been continued over a long period of time. It has been further observed in these studies that nephritics have a fixed low rate of excretion, while individuals with normal renal function will rapidly excrete the drug. One such observation showed a concentration of 17 milligrams of KI per 1 cubic centimeter of urine. The procedure recommended is to begin with the desired dosage; e. g., 10 grains t. i. d. increased 1 grain a day, and examine both blood and 24-hour specimens of urine at intervals. A fixed low daily urinary excretion considerably under the daily intake, accompanied by an increase in the blood iodides, is the indication to substantially decrease the dosage. Such determinations in the patients suffering symptoms of iodism will differentiate between those cases due to actual retention (where a low dosage would be well tolerated) and those having an actual idiosyncrasy for the drug.

#### THE TEST

The same test used for urine may be applied to blood filtrate. It depends upon reduction of the potassium iodide to iodine by the action of hydrogen peroxide and solution of the iodine in a measured quantity of chloroform, yielding a violet color which is compared with a set of sealed standard tubes. The reaction is as follows:  
$$2\text{KI} + \text{H}_2\text{O}_2 = \text{I}_2 + 2\text{KOH}.$$

This reaction is made complete by adding sufficient acid to combine with the potassium hydroxide and convert it to an inactive salt. Hydrochloric acid is used in the case of urine, and trichloroacetic for blood.

## METHOD FOR URINE

1. Place 2 cubic centimeters of urine in a 10-cubic-centimeter test tube identical with the standard tubes.

2. Add one-tenth cubic centimeter concentrated hydrochloric acid.

3. Add 1 cubic centimeter hydrogen peroxide.

4. Add 2 cubic centimeters of chloroform.

5. Stopper and roll the tube slowly back and forth across the table until the maximum color has developed. Avoid violent agitation, which tends to emulsify the chloroform and aqueous layers.

6. Compare after 10 minutes with standard tubes.

In cloudy urines or those containing large quantities of albumin it may be necessary to first heat and filter, having acidified the specimen with concentrated hydrochloric acid.

## METHOD FOR BLOOD

1. Take 10 cubic centimeters of citrated whole blood.

2. Add 9 cubic centimeters of distilled water.

3. Add 1 cubic centimeter saturated solution of trichloroacetic acid.

4. Shake for three minutes in a stoppered Florence flask and filter.

5. Proceed as in the urine test, using twice the quantity of filtrate (4 cubic centimeters) and omitting the addition of the hydrochloric acid.

## PREPARATION OF STANDARDS

Select twenty 10-cubic-centimeter test tubes of uniform size and add quantities of a 0.1 per cent solution of potassium iodide and the other reagents as follows:

Tube No.	Milli-grams per cubic centimeter	KI 0.1 per cent solution	Distilled water	Concentrated HCl	Chloroform	Hydrogen peroxide
		Cubic centimeters	Cubic centimeters	Cubic centimeters	Cubic centimeters	Cubic centimeters
1.....	1.0	2.0	0	0.1	2	1
2.....	.9	1.8	.2	.1	2	1
3.....	.8	1.6	.4	.1	2	1
4.....	.7	1.4	.6	.1	2	1
5.....	.6	1.2	.8	.1	2	1
6.....	.5	1.0	1.0	.1	2	1
7.....	.4	.8	1.2	.1	2	1
8.....	.3	.6	1.4	.1	2	1
9.....	.2	.4	1.6	.1	2	1
10.....	.15	.3	1.7	.1	2	1
11.....	.1	.2	1.8	.1	2	1
12.....	.09	.18	1.82	.1	2	1
13.....	.08	.16	1.84	.1	2	1
14.....	.07	.14	1.86	.1	2	1
15.....	.06	.12	1.88	.1	2	1
16.....	.05	.10	1.9	.1	2	1
17.....	.04	.08	1.92	.1	2	1
18.....	.03	.06	1.94	.1	2	1
19.....	.02	.04	1.96	.1	2	1
20.....	.01	.02	1.98	.1	2	1

The twentieth tube should show no perceptible color. Dip the stoppers in melted paraffin, withdraw as much air as possible from the stoppered tubes with a hypodermic needle inserted through the stoppers, and dip the upper half inch of the tubes in melted paraffin. Standards thus prepared will not deteriorate appreciably in three to four months. Each tube is marked with the number of milligrams of iodine expressed as potassium iodide per cubic centi-

meter of chloroform (half the amount added to the tube), so that readings are made directly in milligrams of potassium iodide per cubic centimeter of blood or urine, and no computation is required. The method is capable of detecting 10 parts per million or one-thousandth of 1 per cent of potassium iodide.

#### CONCLUSIONS

(1) A simple method has been described for estimation of iodine expressed as iodides in blood and urine.

(2) It is believed that such estimations will prove of practical value to clinicians prescribing iodides, and will help to prevent serious symptoms of iodism in patients with impaired renal function.

(3) Attention is called also to the use of this test in cases where there is doubt as to whether or not patients are actually taking iodides as prescribed.

#### REFERENCES

(1) Yoshimatsu, Shun-Ichi, and Sakurada, Hiroshi: A simple colorimetric method for the determination of iodine in urine. *Journal of Experimental Medicine*, 8:107, November 4, 1926.

(2) Leitch, Isabella, and Henderson, John McAskill: The estimation of iodine in foodstuffs and body fluids. *Journal of Biochemistry*, 20:1003, 1926.

(3) Rowntree, L. G., and Fitz, R.: Studies of renal function in renal, cardio-renal, and cardiac diseases. *Arch. Int. Med.*, 11:258-87, 1913.





# NAVAL RESERVE

## MEDICAL CORPS

### APPOINTMENTS, FOURTH QUARTER, 1931

Name	Rank	Appointed
Bills, Marvin Lee.....	Lieutenant, MC-V(S).....	Aug. 10, 1931
Campbell, William Allan.....	do.....	Sept. 16, 1931
Cardwell, John Leland.....	Lieutenant (junior grade), MC-V-(G).....	Aug. 20, 1931
Covington, John M. Clayton.....	do.....	Sept. 11, 1931
Denton, Charles Leroy.....	do.....	Nov. 18, 1931
Hicks, Wayland Keith.....	do.....	Oct. 13, 1931
Jones, Edward Winslow.....	do.....	Do.
Liljencrantz, Eric.....	do.....	Nov. 10, 1931
Sheddon, William Martindale.....	Lieutenant, MC-V(S).....	Sept. 8, 1931
Sutherland, Ross.....	do.....	Aug. 31, 1931
Tarry, George William.....	Lieutenant (junior grade), MC-V(G).....	Oct. 12, 1931

### PROMOTIONS

Name	From—	To—
Ballenger, Irby B.....	Lieutenant (junior grade), MC-V(G).....	Lieutenant, MC-V(G).
Davies, Drew L.....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.
Koebbe, Ezra E.....	Lieutenant, MC-V(G).....	Lieutenant commander MC-V(G)
Kracke, Roy R.....	Lieutenant (junior grade), MC-V(G).....	Lieutenant, MC-V(G).
Petrone, Francis J.....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.

### TRANSFERS

Name	From—	To—
Franklin, Henry L.....	Lieutenant commander, MC-F.....	Lieutenant commander MC-V(G).
Giles, William B.....	Lieutenant, MC-F.....	Lieutenant, MC-V(G).
Heegler, Fred D.....	Lieutenant (junior grade), MC-V(G).....	Lieutenant (junior grade), MC-F.
Mayne, Roy M.....	do.....	Do.
McMahon, Henry E.....	do.....	Do.

## DENTAL CORPS

### APPOINTMENTS, FOURTH QUARTER, 1931

Name	Rank	Appointed
Alpert, Julius L.....	Lieutenant (junior grade), D C-V(G), U. S. N. R.....	Oct. 9, 1931
Berg, Bernard.....	Lieutenant, D C-V(S), U. S. N. R.....	Oct. 1, 1931
Jaffe, Sidney S.....	Lieutenant Commander, D C-V(S), U. S. N. R.....	Oct. 6, 1931
Miller, Earl B.....	Lieutenant (junior grade), D C-V(G), U. S. N. R.....	Nov. 10, 1931
Stock, Clarence A.....	Lieutenant, D C-V(G), U. S. N. R.....	Oct. 20, 1931
Wirth, Frederick H.....	Lieutenant (junior grade), D C-V(S), U. S. N. R.....	Oct. 31, 1931



## NOTES AND COMMENTS

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### THE NAVAL MEDICAL BULLETIN

This number of the NAVAL MEDICAL BULLETIN marks its twenty-fifth anniversary. First issued in April, 1907, as a pamphlet of some 50 pages, it was not long in reaching a size limited primarily by the expense of publication. That it developed correspondingly in value and influence has been evidenced by quotation of its articles in many professional and lay publications in this country and abroad and the constant requests for copies or reprints of special articles from all parts of the world.

On this anniversary occasion it would seem particularly appropriate to give the readers an account of just how this official quarterly of the Bureau of Medicine and Surgery originated.

When in 1906 Dr. William H. Bell, then a passed assistant surgeon, reported for duty in the Bureau of Medicine and Surgery and took charge of the division which was responsible, among other duties, for the preparation of the Annual Report of the Surgeon General of the Navy, he became impressed, in the course of reading reports from the various medical officers, with the rich potentiality of the field of their labors in matters of medical interest and value, primarily to the service, but also to the profession at large. Special reports on selected or designated subjects were being received from time to time, but in general the possibilities were merely suggested in brief concentrated reference to work done or observation made and not completely realized. Such information usually came embodied in periodic official communications along with a mass of routine sanitary and statistical and other data. In other words, much of the material which attracted notice was not developed in detail or presented in a form suitable for utilization, though, as in the case of special reports, even if presented as prepared articles, there was no provision for publication other than the Surgeon General's report, and that was not a proper medium either in point of character or timeliness of issue. Indeed, in the known absence of Government arrangements for publishing articles on medical subjects, there was no incentive to prepare and submit them.

If the individual urge to break out in print was sufficiently strong to inspire quest for an opening, it could be found in the pages of

medical journals under civilian control. This frequently happened with highly creditable articles, but the subject matter that was acceptable to these publications was limited, and it also thus only indirectly and uncertainly reached those of the service who were most interested. In particular the results of those conceptions, observations, and studies which were of immediate concern to the Navy under the conditions and circumstances of practice peculiar to it were not of wide interest and could find no existing medium for their communication. Moreover the effort involved, which included reference to the department for permission to publish, was discouraging. Latent ability and scientific resources were being neglected. The opportunity of the many to profit out of the experiences of the few was not being offered, and much in individual possession was being denied the service for lack of suitable means to capitalize it.

The provisions in personnel, equipment, and accommodation had been or were being modernized and perfected. Steps had been taken and provision made to give such opportunities for professional refreshment as would keep the abilities of the Medical Corps up to date and on tiptoe. There was lacking the thing which would point and give broader range and effect to individual initiative, ability, and activity and to secure that cooperation toward, and finally in a higher plane of service to, the institution of which the Medical Department of the Navy was an important part.

There is no one thing which so entirely makes for thoroughness and exactitude and professional alertness as the invitation implied by the press to work up and present to others one's ideas and discoveries. It was to supply this missing factor in an otherwise progressively developing medical service that Doctor Bell suggested a periodical. Nothing but a Government printed periodical under the complete control of the Medical Department would satisfy the requirements. The idea was presented to the then Assistant Chief of the Bureau of Medicine and Surgery, Surg. W. C. Braisted, and talked over with him and others at the time on duty in the bureau, and finally the proposition in more developed form was laid before the chief of bureau, then P. M. Rixey, Surgeon General, United States Navy.

Doctor Rixey was always receptive and alive to any innovation which gave the slightest promise of advancing the proficiency of the Medical Department in the discharge of its varied responsibilities. It was an objective which had been uppermost in his mind and a guide to his tireless activity from the moment of taking office at the head of his department, and the idea of a medical publication for the service fitted into his general scheme of improvement. He was quick to see its advantages and gave his prompt approval. In launching the idea nothing more was required except its authorization by

the office of the Secretary of the Navy, and this was unhesitatingly given on March 20, 1907, by Truman H. Newberry, then Acting Secretary.

The UNITED STATES NAVAL MEDICAL BULLETIN therefore came into being as an official quarterly means of reaching the Medical Department at large with information of all kinds designed to strengthen the hand of its individual and collective representatives throughout the service in furthering the welfare of the naval personnel. The preface to the first volume is indicative of its aim.

Doctor Bell was not only the originator of the BULLETIN but its first editor and continued so until the latter part of 1909. He edited the first three volumes except No. 4 of volume 3, which was edited by his successor. At that time the name of the editor did not appear on the publication, as it properly did later and does now.

From the very beginning its outlook was altogether promising, for it immediately won the favor of the entire corps and was given the unstinted support in moral backing and literary contributions of many of the best men in the corps. These men had been doing original and advanced work and had been recording their observations. They were not only acquisitive and productive but, as events promptly showed, were restive to communicate the results of their enterprises for the benefit of others. The BULLETIN had the effect of lighting the fuse of an already loaded gun. This was not general, but ability to contribute to progress in the medical sciences was widespread, and the establishment of the BULLETIN involved the stimulation of that ability. Invitation to share the fortunes of this service organ of professional expression was broadcast, and the response left no doubt that the child would not only survive but thrive. The founding of the BULLETIN created a new inspiration to careful, thorough, and original work which was felt almost immediately.

Following the publication of the first three volumes, opinion as to its right to continued existence in the realm of medical literature was asked of the head of the library of the Surgeon General of the Army. Colonel McCaw was not categorical in his reply, but said in effect that if he were called upon to eliminate the unworthy medical periodicals from the library shelves the NAVAL MEDICAL BULLETIN would *not* be one of them. It need only be said that in the passing of years the NAVAL MEDICAL BULLETIN has not deteriorated. It has been somewhat changed in the arrangement of published material from time to time and for a period of years (January, 1922, to December, 1925, inclusive) it was a monthly. Its vicissitudes were financial rather than literary, and it successfully weathered these and has arrived at its silver anniversary a vigorous and creditable justification of its founding.

Again in 1930 the judgment of the library of the Surgeon General of the Army was sought. Col. P. M. Ashburn, its commanding officer, had this to say, "It is a valuable publication, which is both an inspiration to good work by the Medical Corps of the Navy and an evidence of its good work."

No lightly considered thought to discontinue it should be entertained, and if by unsurmountable need discontinuance should unhappily occur the Medical Department and service would suffer infinitely more damage than could possibly be seen in the surface consequences. It is a telling resource in the bureau's effort to keep the field of Medical Department activity on a high plane and to accomplish its mission as a coordinate branch of the Navy.

In keeping with the occasion, in addition to the first editor, due acknowledgement should be given the succeeding editors, whose painstaking and unselfish work has done so much to insure the success of the BULLETIN. These officers are: Drs. C. N. Fiske, J. C. Pryor, R. W. McDowell, T. W. Richards, J. L. Nielson, L. W. Johnson, R. C. Ransdell, J. S. Taylor, W. M. Kerr, L. Sheldon, and R. P. Parsons.

#### POSTGRADUATE TRAINING

In November, 1929, a board was formed to estimate the current and expected needs as to the number of Medical Department personnel required in each of the several specialties and to select personnel for assignment to postgraduate training in order to meet these needs.

The board has since met at regular intervals, and its functioning has brought about gratifying progress in removing the shortage in certain fields.

The number qualified and the number required in the various specialties at the close of the fiscal year 1931 were given in detail in an article, Some Aspects of the Personnel Division of the Bureau of Medicine and Surgery, by Capt. K. C. Melhorn, Medical Corps, United States Navy, which appeared in the January, 1932, number of the BULLETIN.

During the fiscal year 1931 Medical Department personnel were assigned to courses of postgraduate training as follows:

Medical officers:		Dental officers:	
Surgery -----	7	Dental prosthesis -----	4
Internal medicine -----	5	Root-canal therapy -----	2
X ray -----	3	Prosthodontia -----	3
Bronchoscopy -----	3	Nurses:	
Cardiology -----	2	Anesthesia -----	2
Eye, ear, nose, and throat ---	2	Physiotherapy -----	2
Neurology -----	1	Pharmacists:	
Urology -----	3	Accounting -----	3

**As stated in the BULLETIN for April, 1931:**

The bureau is constantly seeking personnel having knowledge and experience in special fields in order to meet special needs at hospitals, certain naval stations, special units at sea, at foreign shore stations, and with expeditionary forces.

The bureau desires to assist those who are anxious to develop themselves in a chosen field. Assistance is being given in the following ways:

(a) For internes, obstetrical and gynecological opportunity in civilian institutions as part of the interne year.

(b) For younger medical and dental officers, particularly those in the rank of lieutenant, assignment to the basic course at the naval medical and dental schools.

(c) Assignment, preferably later and after the basic course, for lieutenants in the Medical and Dental Corps, when practicable to naval hospitals and other naval stations for special temporary duty under instruction in a professional or military specialty, such assignment constituting in the bureau evidence that the individual has begun to definitely associate himself with a chosen specialty.

(d) Favorable action, when practicable, upon requests for civilian courses of postgraduate instruction, preferably after the individual has had the basic course at medical department schools and a special assignment under instruction in a naval activity.

(e) Assignment of established specialists to refresher courses in their specialties from time to time as may be expedient.

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**COMMENDED FOR RELIEF WORK**

In the January, 1932, number of the BULLETIN there appeared a detailed account of the relief work in Managua, Nicaragua, following the earthquake disaster of March 31, 1931, by Commander G. D. Hale and Lieut. Commander H. R. Boone, Medical Corps, United States Navy. For this most creditable work the Secretary of the Navy, on October 10, 1931, addressed commendatory letters to each of the following officers of the Medical Department:

Commander Gordon D. Hale, Medical Corps, United States Navy.

Lieut. Commander Horace R. Boone, Medical Corps, United States Navy.

Lieut. Commander W. T. Brown, Medical Corps, United States Navy.

Lieut. Hugh E. Mauldin, Dental Corps, United States Navy.

The letters of commendation stated:

The Department takes great pleasure in commending you on your devotion to duty and for your zeal and industry in rendering all available assistance to the unfortunate sufferers of the recent earthquake disaster at Managua. Such conduct is in keeping with the highest traditions of the naval service.

95791—32—6

**VISUAL STANDARDS RAISED**

The requirements of vision for promotion to the grades of lieutenant (junior grade) and lieutenant were raised by the following order of the Secretary of the Navy, dated October 3, 1931:

1. It is hereby ordered that the vision of 15/20 and 17/20, respectively, in both eyes, without the use of lenses, be made the requirement for qualification for promotion from lieutenant (junior grade) to lieutenant and from ensign to lieutenant (junior grade).

2. It is further ordered that any candidate for promotion whose defective vision is due to myopia or myopic astigmatism shall be found not physically qualified.

**NOTE.**—This paragraph referring to myopia and myopic astigmatism was canceled later by an order of the Secretary of the Navy, dated December 19, 1931.

Attention of medical officers is called to the fact that the wording of this order is such that it applies only to the line and not to the staff corps.

The following order of the Secretary of the Navy, dated September 8, 1931, likewise raised the requirements of vision for midshipmen on graduation:

1. It is hereby ordered that the vision of 18/20 in both eyes without the use of lenses be made the requirement for commissioning of midshipmen as ensigns in the Navy on graduation from the Academy.

2. It is further ordered that any candidate for graduation whose defective vision is due to myopia or myopic astigmatism shall be found not physically qualified for commission.

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**ADDITIONS AND CHANGES IN NOMENCLATURE OF DISEASES AND INJURIES**

The attention of medical officers is called to the additions and changes in the nomenclature of diseases and injuries which became effective January 1, 1932. The following is a list of the new additions and changes, with the reasons therefor:

*Caisson disease (bends and diver's paralysis)* (2573).—This diagnostic title is deleted from the disease section of the nomenclature and added to the injury section, as caisson disease is really an injury consequent. The specialty letter "U" shall be used.

*Compression (diver's squeeze)* (2574).—Heretofore compression, state part and causative agent (2511), included all compressions due to deep-sea diving. In order to facilitate the study of statistical data submitted to the bureau, compression (diver's squeeze) (2574) is added to the nomenclature. The specialty letter "U" shall be used in all cases of compression due to deep-sea diving.

*Embolism, air, from use of the submarine escape appliance* (2575).—Embolism, air (220), appears under Class II (circulatory system) of the nomenclature. This diagnostic title includes such conditions as artificial pneumothorax, etc. Recent research has indi-



cated that air embolism is an etiological factor in injury following excessively rapid rate of ascent with the submarine escape appliance. For that reason, embolism, air, from use of submarine escape appliance (2575) is added to the nomenclature of injuries to provide a separate diagnostic title to cover injuries that are directly due to the use of the submarine escape appliance. The specialty letter "U" shall be used. Additional study of the subject is in progress with the object of developing a specific method of treatment. Detailed information will be issued to the submarine service in the near future.

*Wound, gunshot, state location and cause* (2576).—This diagnostic title is added to provide statistical data relating to all injuries resulting from the discharge of bullets from small arms (rifle, pistol, shotgun) and projectiles from guns of all calibers. If the projectiles or fragments cause extensive destruction of the body tissue or structure with fatal results, the diagnostic title, "Injuries, multiple, extreme," shall be used.

*Wound, infected, state location and cause* (2577).—A study of the reports received in the bureau revealed the fact that many cases of infected wounds have been reported as cellulitis, thus charging sick days to a disease category which properly should have been included in the injury section of the nomenclature. This diagnostic title is therefore added to include all infected traumatisms. In reporting these cases, indicate on line 14 of the reverse of the Form F card, the cause of the original injury and not the etiology of the infection.

*Agranulocytosis* (112).—This diagnostic title has been added to the disease section of the nomenclature.

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#### CORRECTIONS

The attention of all officers of the Medical Department is called to the following corrections which should be made in the Annual Report of the Surgeon General, 1931.

*Page 265.*—Under table "Summary of all operations performed on supernumerary patients, etc."—change number of excision of fistula from 159 to 59.

*Page 265.*—Under table "Instrumental examinations for diagnosis"—change number of bronchoscopies from 1 to 82.

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#### CONTEMPLATED ACTIVITIES IN MALARIA RESEARCH AT GORGAS MEMORIAL LABORATORY

In the October, 1931, number of the BULLETIN mention was made of the Army, the Navy, and the Public Health Service assigning qualified medical officers to the Gorgas Memorial Laboratory for research

work, and that malaria was among the paramount problems for early consideration by the laboratory. In connection with the latter the following "Statement of contemplated activities in malaria research at the Gorgas Memorial Laboratory, Panama, R. de P., with the cooperation of the United States Public Health Service," by W. H. W. Komp, sanitary engineer, United States Public Health Service, will be of interest to naval medical officers:

1. The major problem to be attacked is the determination of the effect of plasmochin on the infectivity of tertian malaria gametocytes. Barber and Komp, Barber, Komp, and Newman, Whitmore and Amies have shown that small doses of plasmochin so affect the gametes of estivo-autumnal malaria that mosquito infection is prevented. The series presented by these groups of workers is small, and only a few cases of tertian malaria were studied. It is hoped to increase the series of estivo-autumnal cases by as large a number as possible, but in particular to obtain a large series of tertian malaria cases. It should be noted that for experiments of this sort tertian malaria is more difficult to work with than is estivo-autumnal, for three reasons. In the Canal Zone and the Republic of Panama, it forms only about 25 to 30 per cent of the total malaria, as determined by surveys and hospital records. It never produces the often enormous numbers of gametocytes found in estivo-autumnal cases, and hence infections are more difficult to demonstrate. Quinine, which has little or no effect on the gametocytes of estivo-autumnal malaria, exerts a deleterious effect on the gametocytes of tertian malaria. Hence severe hospital cases are available for use only for a short time before quinine is administered. Any further use of subjects with tertian malaria undergoing quinine treatment would be open to serious objection, as the effect of quinine alone could not be separated from that of the plasmochin. The use of subjects discovered in routine malaria surveys of native villages is difficult and unsatisfactory, due principally to meager transportation facilities. The results of such surveys are not known until several days after the slides have been taken, and subjects which may have had plenty of gametocytes at that time may have nearly entirely cleared of them by the time they are reached for infection experiments. In one such attempt a native boy who at the time of the survey had 122 estivo-autumnal crescents per thousand leucocytes five days later, at the time he was reached, had only 24 per thousand leucocytes. Seasonal variations in the numbers of *Anopheles albimanus* larvæ also add to the difficulties, making it hard to keep a sufficient supply of laboratory-bred adult mosquitoes on hand.

2. During the past several years a number of rare or hitherto unreported *Anopheles* mosquitoes have been found in the Canal Zone. It is proposed to determine their infectibility with malaria. Most of these newly found species are so rare and local that it is only under exceptional circumstances that they could ever play a part in the transmission of malaria. However, this possibility is too great to overlook, as one of the species has quite a wide distribution in the Canal Zone at certain times of the year. This research is surrounded with as many difficulties as the preceding project, as the same procedure must be followed, and, in addition, a large supply of adults of a species of known infectibility (in this case *Anopheles albimanus*) must be available as a control species.

3. Little has been published as to the seasonal and racial incidence of the various types of malaria in Panama. In a rather incidental way it is known that estivo-autumnal malaria forms the bulk of malaria infections, but little is definitely known as to the seasonal and racial incidence. Through the courtesy of the staff of Gorgas Hospital, the director of the Board of Health Laboratories of the Canal Zone, and the director of Santo Tomas Hospital in Panama, the writer has been able to obtain a large number of slides from hospital cases, together with accompanying data thereon. It is planned to publish the results of his investigations when sufficient material has been accumulated.

4. In connection with studies of malaria control in rural communities in Panama extensive surveys have been made in the past in certain selected areas. It is planned to continue these malaria surveys in conjunction with the control measures. Monthly surveys will be made, the results as to species of parasite, race of individual, age, sex, and other factors tabulated, and the whole included in a series of papers dealing with the problem of rural malaria and its control in Panama.

5. In such a fertile field for malaria research as is offered by the Canal Zone and the Republic of Panama opportunities for study of many angles of the disease continually occur. It is planned to collaborate in the investigation of any new problems which may arise during the course of the tour of duty. Several interesting problems have already been made the subject of study, among them being the feasibility of extending malaria-mosquito control by airplane dusting with Paris green; the use of airplanes for oiling swamps breeding salt-marsh mosquitoes; observations on the flight of *Anopheles* and their seasonal incidence; observations on the life history of little-known species of mosquitoes; taxonomic studies of rare forms; and the description of new species as found.

**A SPLENDID JOB OF PREVENTION AND CONTROL**

Appearing under the above caption, the following item of interest, originally taken from the Medical Department Bulletin No. 17, office of the surgeon, headquarters Philippine Department, is quoted from the section on Medical and Military Notes in the Military Surgeon, September, 1931:

The venereal rate of American troops in China reached a high mark for all time during the latter part of last year. For the month of October it was 566 per M per annum. About this time the commanding officer and his medical staff got together and started an intensive campaign, with results as shown in extracts from sanitary report for April and surgeon's letter, May, 1931:

During the month of April, 1931, one case of gonorrhea occurred in the command. This case quite evidently was one of long duration which had suffered an acute exacerbation. It was the first one which had occurred in the command since January, 1931, and is not properly chargeable.

The intensive campaign against venereal disease has continued. The use of the prophylaxis at the station hospital is in force, but the soldier is also provided with a prophylactic packet to be used "on the spot," so that the element of elapsed time is eliminated. Soldiers are also ordered to use the condom.

Squad leaders in all organizations are required to make a venereal inspection of squad members once in every 48 hours and to report to a medical officer any abnormality, including the most significant appearing scratch or abrasion. Such scratches or abrasions are treated with murcurochrome solution and the man restricted to the compound, receiving daily observation until the trauma has disappeared. Usually a few days' restriction suffices.

The excellent results obtained for a period of more than three months cannot be attributed to any one factor, but the surgeon is of the opinion that primarily it is an administrative triumph and that the commanding officer, by his forceful insistence upon the regulations being observed, is responsible.

The 48-hour inspection of all men by squad leaders with early detection and treatment of aforementioned scratches and abrasions may account for the decrease in chancroid infections, but only the use of the condom and the prophylaxis can account for the clean record for gonorrhea and syphilis.

"Your letter dated April 23 at Bagulo arrived this morning. I am glad you say you want me to write from time to time, for I am desirous of doing so. I know of no report that can be quite so informative as a personal letter.

"The venereal situation remains surprisingly good—excellent. I do not propose to explain reasons for the marvelous results, but in my opinion it is due to the fact that the men are actually using the condom and prophylactic treatment. They are afraid not to. Our lay brothers appear to think that there is something new under the sun. I think they are right. The regulations are being enforced! Raycroft deserves much credit in this reduction of the venereal rate, for the men have confidence in him and undoubtedly waste no time in coming to him earlier than has ever been the case in my experience. Whether small abrasions treated at once is a preventive for chancroids I do not know, but the men think it is, and it is not a bad thing to have them think so. The fact is that no such treatment will prevent gonorrhea or syphilis, and these diseases are also down to the negligible point. My opinion will continue to give much credit to enforcement of the orders. Colonel

Taylor gives Raycroft credit for having sold the idea to him that the terrible situation could be very much improved. We are strong for giving the commanding officer the credit and responsibility.

"JOHN T. AYDELOTTE"

#### THE PROSPECTS OF VACCINATION AND VACCINE THERAPY IN TREPONE- MATOSES

Under the title above, Dr. Otto Schöbl, in the Philippine Journal of Science for October, 1931, makes the following interesting and important statements:

The clinical course and the ultimate result of treponematous infections, like those of any other infection, are determined by the biology of the parasite and by the immunity that develops in the course of the infection \* \* \*. The clinical course of the infection in the treponematoses and its consequences are determined in the early stage of the disease by the relative number of parasites. The earlier the immunity develops, the shorter and less tragic is the course of the disease. Further progress of the disease is halted in any stage of the disease whenever full immunity sets in. The immunity in treponematoses can be accelerated by artificial means, and the course of the disease can be influenced thereby. A high degree of immunity can be made to set in before the expiration of the incubation period of the primary, or of the generalized so-called secondary manifestations, or of the late forms. \* \* \*

\* \* \* The experimental evidence on which these statements are based has been published, likewise the possibility of preventive vaccination and vaccine therapy in treponematoses has been demonstrated on animals. \* \* \*

In animals immunized with lifeless treponematous antigen, only the early serologic response becomes evident, that is, the one which is coincident with the primary lesion in case of infection. The late response is absent in case of vaccination with killed treponemas, or it is possible that it is very much delayed.

If generalized manifestations appear, following the development of the initial local lesion, the late serologic response as well as the development of immunity is accelerated \* \* \*.

\* \* \* From the serologic and immunologic standpoint, the preventive vaccination takes the place of the primary lesion, and the infection that follows the preventive vaccination takes the place of the generalization of the treponematous infection, the so-called secondaries. Clinically speaking, there are several possibilities when treponematous infection invades the vaccinated body organism. The result depends on the time relation between the incubation time of the infection and the speed of the acceleration of immunity as a consequence of the infection itself. If the time necessary for the accelerated immunity to reach a high degree is shorter than the incubation of the infection in the vaccinated body organism, then no lesion develops. If the time required by the immunity to be accelerated to a high degree by the subsequent infection is longer than the time of incubation, a local primary lesion develops, but the immunity is raised thereby, to a high grade, before the time when the generalized manifestations (the secondaries) or the late forms (the tertiaries) can occur. Consequently, following the primary lesion, no subsequent stages of the disease develop.

Specific antitreponematous treatment, when administered in the early stage of a primary lesion, delays the onset of immunity far beyond the time at which immunity sets in if infection is allowed to run its course without treatment. Under these circumstances treponematous reinfection or relapses, if the treatment was not complete, are possible for a long time. Vaccine therapy, administered after early specific cure, accelerates the immunity. Within a short time after the vaccine therapy has been administered a reinfection is no longer possible \* \* \*. Thus reinfection after early cure may be prevented by vaccine therapy, or in case that primary lesion develops due to reinfection no further stages of the disease will develop.

Vaccine therapy administered to an infected host without previous or simultaneous specific antitreponematous treatment provokes a negative phase and severe lesions may appear in such a case.

\* \* \* Whether administered to a healthy body or to a previously infected host the antitreponematous vaccination is a preventive measure and tends to hasten an immunity that, in turn, prevents the development of subsequent stages of the disease. It has no apparent healing effect on the lesions that have already developed. The vaccination with killed treponemas is a controllable and harmless substitute of a severe early treponematous infection that, as experimental evidence and clinical observation show, prevents the development of late stages of the disease.

These statements with regard to vaccination and vaccine therapy are based on experimental evidence and refer to experimental animals.

A fair estimate can be made of the possibilities of vaccination and vaccine therapy in treponematous infections in man. This estimate has not been made by merely applying the experimental findings made in monkeys to man, but by drawing a comparison between the conditions experimentally found in monkeys and the conditions that were found in experimentally inoculated humans. \* \* \*

\* \* \* We may, therefore, rightfully hope that this procedure will be a valuable addition to our present armament for combating human treponematoses, that is, yaws and syphilis.

#### TOXIC EFFECTS FOLLOWING USE OF ARSPHENAMINES

In a 10-year period, H. N. Cole, Henry De Wolf, J. M. McCuskey, H. G. Miskjian, G. S. Williamson, J. R. Rauschkalb, R. O. Ruch, and Taliaferro Clark (Journal American Medical Association, September 26, 1931), gave about 78,350 injections of arsenicals in the treatment of syphilis. Of the 1,212 cases studied, 19 per cent in the latent stage showed complications of treatment, against 14.3 per cent in the early stage. Of the 214 patients presenting complications, the ones in the age group 40 to 49 had the highest percentage of involvement and the ones under 19 the least. Females were more sensitive than males, and white females more sensitive than negro females. Arsphenamine and neoarsphenamine were used in about 97 per cent of the cases and the two 79 per cent and 21 per cent, respectively. The most frequent complication was a severe gastrointestinal reaction; next, slight skin eruptions with pruritus; next, nitritoid reactions; next, dermatitis exfoliativa; next, icterus, and then hemorrhagic encephalitis. The frequency of reactions was about the same for arsphenamine and for neoarsphenamine, though

icterus was more common after the injection of neoarsphenamine than after arsphenamine. Four of six fatal cases of hemorrhagic encephalitis were due to sulpharsphenamine. Both cases of purpura were also due to this drug, yet it was used relatively little in comparison to the enormous amount of arsphenamine and neoarsphenamine. Arsenical icterus was twice as common in persons over 35, as were also nitritoid reactions. Arsenical hemorrhagic encephalitis is a complication of young adulthood. A patient sensitive to one arsenical will be more liable to sensitivity to other arsenicals. One of the authors' patients was susceptible to arsphenamine, neoarsphenamine, sulpharsphenamine, and tryparsamide. The sensitivity to an arsenical will probably persist, even for years. If the patient has had an arsenical dermatitis one should be very careful about further injections even years later. The percentage of persons having arsenical reactions rises from the sixth to the twentieth injection. The incidence also increases markedly around the fortieth injection. The most severe arsenical reactions were noted in the period from two to three months up to one year of the syphilitic disease. Hemorrhagic encephalitis is essentially a complication seen early in the course of a syphilis, even coming after from two to four injections of the arsphenamines. Though dosage is a factor in the causation of arsenical reactions, one may note them even with very small doses. There were 12 deaths in the series—6 from hemorrhagic encephalitis, 5 from crustaceous dermatitis exfoliativa, and 1 from acute severe arsenical hepatitis, all in patients treated less than six months. The best treatment of arsenical intoxications occurring in the treatment of syphilis is prophylaxis. All patients under arsenicals should be carefully questioned as to untoward reactions, then stripped and the skin examined for evidence of eruptions. Two patients who died of dermatitis exfoliativa, sent to the authors in consultation, had been given another injection of neoarsphenamine after they already had an erythema from the last treatment.

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#### SUPRAPUBIC PROSTATECTOMY

Oswald Swinney Lowsley and Thomas J. Kirwin, New York (Journal American Medical Association, December 5, 1931), believe that the surgeon operating on the prostate must adapt the procedure employed to the special needs of the patient involved; there can be no routine technic applicable to all cases. Suprapubic prostatectomy is a 1-man operation; perineal prostatectomy requires cooperation of a trained team. If the prostatic hypertrophy has dilated the internal sphincter, enucleation of the gland is better done by the suprapubic route. When the enlarged gland has remained within its natural anatomic limits, it can be reached more safely and conveniently by way of the perineum. The authors pre-

fer the technic of suprapubic prostatectomy devised by Freyer over 30 years ago; that is, enucleation of the gland through an incision in its capsule, using the finger to detach it from the capsule, and observing great care not to injure the plexus of Santorini situated at the top of the vesical sphincter, as such injury is likely to induce severe hemorrhage. As suprapubic enucleation is prone to tear the mucosa from the verumontanum, thus exposing the orifices of the ejaculatory ducts to infection, a bilateral vasectomy should always accompany suprapubic prostatectomy. Preliminary drainage is a prerequisite to successful prostatectomy, but may be accomplished in a number of ways, according to the needs of the individual patient. Cystotomy employing MacGowan's transverse incision, vesical puncture with Kidd's instrument, and the indwelling catheter have all given satisfaction.

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#### ETIOLOGY OF POSTVACCINIAL ENCEPHALOMYELITIS

Richard Thompson, New York, writing in the Archives of Pathology of October, 1931, summarizes the present status of the etiology of postvaccinial encephalomyelitis as follows:

The three most important etiologic theories may be briefly considered again: There is much evidence in favor of the assumption that postvaccinial encephalitis is caused by the direct action of vaccine virus on the brain, but two important objections to this are not yet satisfactorily explained—the lack of vaccine virus in the brain in most cases and the differences between the lesions in man and those produced experimentally in animals. The work of McIntosh may, with further corroboration, remove the second obstacle. The epidemiologic facts apparently opposed to this theory can be explained by the assumption of variations in susceptibility to the encephalitogenic action of the vaccine virus. The theory of an activation of some unknown virus is largely supported as an alternative explanation by those who regard the obstacles to the acceptance of the first explanation as unsurmountable. There is little, if any, positive evidence in favor of this theory which can not be equally well explained on the basis of the theory that the vaccine virus is the cause. The conception of an allergic reaction as an explanation has no direct evidence in its favor.

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#### SCARLET FEVER STREPTOCOCCUS ANTITOXIN IN THE TREATMENT OF SCARLET FEVER

In the United States Public Health Service weekly report of December 18, 1931, (vol. 46, No. 51), M. V. Veldee, F. E. Stevenson, and A. Graeme Mitchell have contributed an article giving a detailed statistical analysis of a carefully controlled clinical study of the therapeutic value of scarlet fever streptococcus antitoxin. The study was conducted in the Cincinnati General Hospital.

In their discussion the authors state:

We have attempted to present in this report a detailed analysis of each case included within our study, the purpose being not only to note the more obvious clinical variations in our three groups but also to analyze the records



more minutely with a view to determining wherein, if at all, scarlet fever streptococcus antitoxin fails to accomplish its purpose.

That the antitoxin has a specific neutralizing effect on the toxin *in vivo* is indicated by the decrease in the duration of the rash, by a change in the character and extent of the desquamation, and by a reduction in the number of complications. That it failed to neutralize completely the damaging effect of the toxic substances produced by the scarlet fever infection is suggested by the failure of the rash to disappear promptly, by the continuation of the fever, and by the appearance of complications in a certain number of serum-treated cases.

These failures may have been caused by (a) too small a therapeutic dose, (b) an improper method of administration, (c) administration too late in the disease, or (d) an inadequacy of antitoxin to neutralize all of the toxic substances elaborated in this disease. It is our belief, and this is confirmed by other clinicians and by investigations of the action of scarlet fever toxin, that early administration of antitoxin and its rapid dissemination throughout the body of the patient are essential; the toxin being elaborated very early in the disease and effecting its tissue damage without delay.

The probability of serum sickness must also be weighed in the use of scarlet fever antitoxin. However, the frequency of this complication can not be attributed entirely to a peculiar property of an antistreptococcic serum itself, since it was shown that previous sensitization to horse serum played an important rôle in its incidence. With the introduction of a more effective method of producing active immunity against diphtheria by the use of toxoid instead of toxin-antitoxin mixture, there will be a corresponding reduction in the percentage of children sensitized to horse serum. There is also the fervent hope that ultimately an improved method of manufacture will become available so that the volume of the therapeutic dose of scarlet fever streptococcus antitoxin may be greatly reduced, which in itself will minimize the probability of serum sickness.

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#### APPRAISAL OF PRESENT TREATMENT OF DIABETES

According to Elliot P. Joslin, Boston (Journal American Medical Association, August 29, 1931), the present treatment of diabetes is better than is often thought and therefore one should be slow to depart from standard methods. The average patient who consulted him in January, 1931, had already lived half again as long (6.1 years) as his confrère of January, 1922. Indeed, judged by the duration of his disease the average diabetic patient in January, 1931, would have been dead in the January prior to the discovery of insulin, because at that time the total span of life of the diabetic patient did not exceed six years. Furthermore, this January's diabetic patient was older by 8 years, his average age being 50 years instead of 42. The proportion of males had decreased to 44 per cent in contrast to 47 per cent in 1921 and 55 per cent a decade before, again illustrating the remarkable change that has taken place in diabetic sex distribution. The first year of diabetes is now the safest for the patient, whereas formerly it was the most serious. First year mortality can not drop much lower than the 4 per cent.

it has now reached, because so many cases are encountered in the aged. To-day every physician realizes that coma is an accident or the result of neglect, and, although arteriosclerosis has largely taken its place in diabetic mortality, diabetic gangrene, which is its most common expression, occurs almost exclusively in the ignorant and indigent, so effective has been prophylaxis. A growing percentage of diabetic patients now outlive their life expectancy and a leading insurance company acknowledges that, since the discovery of insulin, diabetic mortality has decreased in the young and that its rise in the old is largely to be explained not by an increase in the disease but rather because of an increase in the total number of known diabetic patients. Soon, even if not to-day, one can say to the patient developing diabetes in 1931 that the chances are certainly 1 in 10 and perhaps 1 in 5 of his living longer with diabetes than will his average neighbor of the same age without it. Since the average duration of diabetes in the average living patient is now so much greater than that in the recently fatal case, the problems of treatment are new problems and must be recognized as such and met with an open mind. An unexplored diabetic land lures one on. With the wide divergence in types of treatment now in vogue, physicians and patients can easily become hopelessly confused unless fundamentals are emphasized by all.

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#### PRESENT STATUS OF ANESTHESIA PROBLEM

Arthur Dean Bevan, Chicago (Journal American Medical Association, November 21, 1931), reviews briefly the subject of anesthesia, tests the various anesthetic agents by the scheme of measurement which his associates and he have devised, and attempts in a judicial way to determine what anesthetics are to-day the safest, most efficient, and most practical for use in a general surgical clinic. He believes that the use of chloroform, of intraspinal anesthesia, of intravenous anesthesia, of intrarectal anesthesia, of intratracheal anesthesia, and of the so-called basic anesthetics, such as scopolamine, avertin, and amytal, must be limited to very narrow fields. Fortunately, local anesthesia, gas anesthesia, and ether afford three anesthetic measures which, if handled by an expert, can be used alone or in sequence, with abolition of pain and, if desired, the abolition of consciousness and, when required, complete relaxation, and can secure complete and safe anesthesia for any and all surgical operations. This places anesthesia on a very unpretentious, simple basis, but here, as in all fields of surgery, it finally becomes apparent that simplicity is near truth. The author believes that the general adoption of this simple scheme of anesthesia will prevent many anesthetic accidents and save many lives.

**SEROLOGICAL AND INTRADERMAL TESTS IN FILARIASIS**

Writing on this subject in the Transactions of the Royal Society of Tropical Medicine and Hygiene, April, 1931, Dr. N. Hamilton Fairley makes the following comments:

Immunological investigation in schistosomiasis has shown that antigens prepared from mammalian schistosomes are effective in the diagnosis of the three species of bilharzia parasites infesting man either by the complement-fixation reaction or by the skin test. Evidence presented in the present paper indicates that we are here dealing with a similar group reaction for the filarioid species of the family Filariidae, and possibly for the family Fuelleborniidae as well, though Fairley and Liston (1924) failed in their attempts to manufacture a satisfactory antigen for complement-fixation tests from adult *Fuellebornius medinensis*. The tests themselves appear mutually complementary, since the complement-fixation reaction detects circulating antibody and affords an index to more active infestation, while the intradermal test taps residual intracellular antibody which may persist long after circulating antibody and the parasites themselves have disappeared.

The practical value of these tests is obvious, for in *L. loa* infestation, where years may elapse before microfilariae are demonstrable, they will enable an early diagnosis to be made, while with *W. bancrofti* it is no overstatement of the case to say that they afford an entirely new mode of approach to the study of this particular disease as well as to the various postfilarial complications classified with it. Further, by these means elephantiasis and chyluria of filarial origin should be readily differentiated from those of nonfilarial etiology.

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**THE MODIFIED BAKER ANCHORAGE FRACTURE ARCH WIRE**

Walter Rehauer, lieutenant commander, Dental Corps, United States Navy, writing in the Dental Cosmos of December, 1931, states that provided there are teeth available for anchorage, the modified Baker anchorage fracture arch wire may be used in all types of fractures of the mandible and maxillae. Its greatest value is in those difficult, complicated cases where dangerous head injuries preclude early reduction and fixation of displaced fragments. In such cases there is usually quite an interval between the incidence of the fracture and the time when the patient is physically able to undergo the reduction process. Because of the fact that reduction with this appliance proceeds slowly and forceful reduction is thereby avoided, treatment may commence earlier without danger of further shock to the patient.

Among the advantages claimed for the appliance the following are mentioned: 1. Enables the operator to move fracture fragments in any plane or direction. 2. Permits an unobstructed view of all the teeth and the oral cavity at all times. 3. Easy to keep clean. 4. Simplicity of adaptation and manipulation. 5. Functions both as a reduction and fixation appliance. 6. Requires very few accessories for its use. 7. Comfortable to the patient. 8. Usually requires

no accessory bandages or headgear. 9. Casts and prosthetic laboratory procedures are not necessary.

The article includes an illustrated chronological case history of a complicated multiple fracture of the maxillae.

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#### HEALTH CONDITIONS IN THE UNITED STATES

In a report made public by the United States Public Health Service, Surg. Gen. H. S. Cumming states that reports of the prevalence of communicable diseases received by the Public Health Service from State health officers and preliminary reports of deaths from several sources indicate that the health record for the United States for the calendar year 1930 was exceptionally good. The record for the first half of the year 1931 was also generally good, although an epidemic of mild influenza during the early months of 1931 increased the death rates for a time and gave the year an inauspicious beginning.

The geographic distribution of smallpox in the United States is very irregular. Seven States—Kansas, Delaware, District of Columbia, Maine, Maryland, New Hampshire, and Rhode Island—reported no cases of smallpox in 1930. The greatest prevalence of smallpox in that year was in South Dakota with 259 cases per 100,000 population. Indiana reported 164 cases of smallpox per 100,000 population and the State of Washington 152 cases per 100,000 population.

During the calendar year 1930 the incidence of influenza in the United States was unusually low. The death rate from influenza for the year 1930 was 18.7 per 100,000 population as compared with 54.6 per 100,000 population in 1929 and 42.1 in 1928. The fact that there was no general outbreak of influenza during 1930 probably helped greatly in keeping the general death rate for the year low, as there is usually an increase in the number of deaths attributed to certain other diseases when influenza is prevalent.

Infantile paralysis was more prevalent during the calendar year 1930 than it was in 1928 or 1929. In the spring of 1930 the reports showed increased incidence of infantile paralysis on the Pacific Coast, and later considerable numbers of cases of the disease were reported in other parts of the country, especially in Louisiana, Oklahoma, and some of the North Central States. In the country as a whole, infantile paralysis reached its peak for the year about the 1st of October. An outbreak began in New York City soon after the close of the fiscal year. This outbreak later reached considerable proportions, the number of cases being considerably in excess of those reported for the preceding year.

The tuberculosis death rate for the calendar year 1930 was the lowest ever recorded by the Public Health Service. It was 68.5 deaths per 100,000 population as compared with 73.1 in 1929 and 76.4 in 1928. In 1900 the Bureau of the Census recorded a death rate from

tuberculosis of 201.9 per 100,000 population. The difference between the tuberculosis death rates of 1900 and 1930 represents a saving of more than 160,000 lives in 1930, which would have been lost from tuberculosis in the United States if the 1900 rate had prevailed that year.

The prevalence of typhoid fever has been decreasing in the United States since comparable yearly statistics of cases and deaths have been available. During the calendar year 1930 a slight reaction was shown by the reports. The increase was reported during the last six months of 1930, and in some States at least it may have been influenced by the drought conditions, which resulted in pollution of water supplies or necessitated the taking of drinking water from new or unknown sources. The typhoid fever rates as computed from reports to the Public Health Service were as follows: 1930, 22 cases per 100,000 population; 1929, 19 cases; and in 1928, 22.7 cases.

The case and death rates for diphtheria in 1930 were the lowest which the Public Health Service has ever recorded—54.2 cases and 4.9 deaths per 100,000 population. Ten years ago, 1920, the diphtheria case rate was 155 per 100,000 and the death rate was 15.3 per 100,000.

From 1924 to 1928, there was an increase in the prevalence of pellagra in the United States. In 1929 the reported incidence of the disease decreased somewhat, and there was a further decrease during the year 1930. During the first six months of 1931, however, 16,385 cases of pellagra were reported to the Public Health Service as compared with 13,359 cases reported during the first six months of the preceding year.

More than 1,450 cases of undulant fever were reported to the Public Health Service for the calendar year 1930. The disease has been recognized in every State of the Union.

Rocky Mountain spotted fever is not reportable in many of the States east of the Rocky Mountains. In 1930, 167 cases were reported from California, Colorado, Idaho, Montana, Nevada, Oregon, Washington, and Wyoming. During the year workers of the Public Health Service identified, by laboratory and clinical studies, Rocky Mountain spotted fever, eastern type, in several States along the Atlantic seaboard. There is evidence to indicate its existence in this area at least since 1909. In 1931 cases were reported in the District of Columbia and Maryland.

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#### HEALTH CONDITIONS THROUGHOUT THE WORLD

Surg. Gen. H. S. Cumming, United States Public Health Service, in a report recently submitted to Congress, indicates that there has been a constant interchange during the past year of sanitary information by the Public Health Service through the International Office

of Public Hygiene in Paris, the Pan American Sanitary Bureau, and other agencies. Useful information relative to the prevalence of disease was also received by the Public Health Service through American consuls, officers of the service stationed abroad, and directly from foreign governments.

Cholera appears every year in parts of Asia, and under present conditions outbreaks in the Philippine Islands may be expected, but the number of cases and deaths are much smaller than they were a few decades ago. Cholera did not appear in continental United States during the past fiscal year, but an outbreak began in the Philippine Islands in May, 1930, and continued throughout the fiscal year. During the calendar year 1930 about 4,600 cases of cholera with about 2,700 deaths were reported in the Philippines. Cholera was more prevalent during the calendar year 1930 than it was during the year 1929, although during 1930 it was not reported outside of Asia and the adjacent islands. In India 366,951 cases of cholera were reported in 1930 and 285,792 cases in 1929.

In South America bubonic plague was reported during the calendar year 1930 in Brazil, Ecuador, Peru, and Argentina. Over the world generally plague was as widespread as it has been in recent years, although the total number of reported cases was smaller than it was in 1929. In 1930, 35,644 cases of plague were reported in India as compared with 97,346 cases in 1929. No human cases of plague occurred in the United States or its possessions during the fiscal year. Plague-infected rodents, however, were reported from California and Hawaii during the year.

During the fiscal year yellow fever was present in Brazil, South America, and in the Gold Coast and British Cameroons in Africa. The disease was not reported in the city of Rio de Janeiro, Brazil, nor in Colombia during the fiscal year, although four cases were reported in Magdalena Province, Colombia, in July, 1931. Soon after the close of the fiscal year in July and August, 1931, cases of yellow fever were reported in Africa and in Brazil.

The world prevalence of typhus fever has been decreasing since the decline of the great epidemics which followed the World War. The disease, however, is still reported from all the grand divisions of the world, the largest number of cases being reported by the Union of Socialist Soviet Republics.

Smallpox is widespread, and during the calendar year 1930 there were cases of the disease reported from nearly all of the countries of the world, although most of the countries of western Europe reported comparatively few cases. In 1930 England and Wales reported more cases of smallpox than did all the countries of continental Europe, and the United States reported more cases than any other single country with the exception of British India.

## BOOK NOTICES

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Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,  
Washington, D. C.

(For review)

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THE AUSTRALIAN ARMY MEDICAL SERVICES IN THE WAR OF 1914-1918, VOL. I, PART I. THE GALLIPOLI CAMPAIGN, by Col. A. G. Butler, D. S. O., V. D., B. A., M. B., Ch. B. Camb. PART II. THE CAMPAIGN IN SINAI AND PALESTINE, by Col. R. M. Downes, C. M. G., V. D., M. D., M. S., F. C. S. A. PART III. THE OCCUPATION OF GERMAN NEW GUINEA, by Col. F. A. Maguire, D. S. O., V. D., M. D., Ch. M., F. R. C. S., and Capt. R. W. Clento, M. D., B. S., D. T. M. and H. Australian War Memorial, Melbourne, 1930. Obtainable in the United States from the Commissioner-General for the Commonwealth of Australia, 25 Broadway, New York City. Price, \$5.25.

This work is a very complete and detailed presentation of the experiences of the Australian Army medical services during the World War.

Each of the three parts that make up the volume, namely, the Gallipoli campaign, the campaign in Sinai and Palestine, and the occupation of German New Guinea, gives a graphic account of how the medical problems involved were gradually solved and the essential principles developed after many trials and failures.

The plan of presenting the medical history of the Australian forces is well described by Col. A. G. Butler, the editor and author of Part I.—

\* \* \* the endeavor of the authors has been to exhibit these problems in the order and in the circumstances in which they arose, and to show at each step of a campaign how they were being met, and in most cases gradually overcome, by the help of experience gained in the previous steps. It is this endeavor that has determined the entire arrangement of the work; and, in order to assist the reader in following its thread, the narrative is summarized in the initial paragraph of each chapter. On the comparatively small stage of Australian experience it has been possible to illuminate the situation involved in the often conflicting duties of the medical service—the military duty of preserving the fighting force by camp and field sanitation, of sustaining its morale by rapid clearance of the wounded, of reinforcing its reduced and

weary garrisons by ensuring the prompt return to duty of men recovered from wounds and sickness, and, on the other hand, the humane duties of minimizing pain and injury, or caring for the wreckage that is no longer of military value, and, if possible, fitting it to take again some part in the nation's work. \* \* \*

The history of the Australian Army medical services could be read with profit by every naval medical officer, particularly the Gallipoli section, which deals with (to quote Colonel Butler) "the general problems of a medical service in combined naval and military operations, a subject matter which, until this campaign, was almost entirely unexplored and of which comparatively little has even now been written."

This volume consists of 835 pages; 228 illustrations, maps, and graphs; appendix; glossary; and a complete personal and general index.

Volume II, in course of preparation, will follow the work of the Australian Army Medical Corps in France and includes a short account of the experience of the medical service with the Royal Australian Navy and Air Force. It concludes with information concerning the medical problems of repatriation, the pension problem, and the care of the maimed.

**SURGICAL PATHOLOGY OF THE DISEASES OF BONES**, by *Arthur E. Hertzler, M. D.*, Surgeon to the *Agnes Hertzler Memorial Hospital, Halstead, Kans.*; Professor of Surgery, *University of Kansas*. J. B. Lippincott Co., Philadelphia, 1931

This book is the first of a series of monographs on surgical pathology by Doctor Hertzler. The work is the result of some 30 years of medical teaching and includes what the author considers "will meet best the needs of the medical student and the budding surgeon."

The subject material is divided into two parts, namely, diseases of bone and tumors of bone. Part I discusses the classification of bone diseases, acute inflammation, osteomyelitis in special regions, chronic inflammations, diseases due to specific infection, and diseases of unknown origin.

Part II discusses the classification of bone tumors, osteomas, chondromas (including chondrosarcoma and chordomas), traumatic ossifying myositis, giant-cell tumors and bone cysts, osteogenic sarcoma, Ewing's endothelial tumor of bone (including angio-endothelioma and multiple myeloma), and metastatic bone tumors.

The method of discussing the various diseases is well described by the author.

I have presented the material under three heads, first, pathogenesis: This includes the development of the disease and is the link between the pathology and the purely clinical. In fact, it is in a measure purely clinical. Pathology: This includes what the surgeon sees and feels, including the physical findings and



gross pathology. It represents the surgeon in action. Histology: This section includes just enough of the finer anatomy to make the gross pathology intelligible. For this reason I have worked largely with low magnifications. I have tried to keep out of the field of the specialist in pathology as much as possible. My object is to serve practical surgery.

The text is supplemented by 262 excellent illustrations. In fact, Doctor Hertzler states, "The story is told as much as possible by means of pictures."

The literature on the subject is given in an unusually practical manner at the end of each chapter.

**SURGICAL PATHOLOGY OF THE SKIN, FASCIA, MUSCLES, TENDONS, BLOOD AND LYMPH VESSELS**, by *Arthur E. Hertzler, M. D., Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kans., Professor of Surgery, University of Kansas.* J. B. Lippincott Co., Philadelphia, 1931

This monograph discusses the surgical pathology of the skin, fascia, muscles, tendons, blood and lymph vessels. The chapter headings are ulcers of the skin, benign epithelial skin tumors, malignant epithelial skin tumors, fibrous tumors of the skin, melanomas, malignant tumors of fascia, diseases of muscles, disease of tendon sheaths, neoplastic diseases of blood and lymph vessels, diseases of blood and lymph vessels, and thrombosis and embolism.

The same plan of presenting the subject material as used in the monograph on the surgical pathology of bones has been followed in this work.

**FUNDAMENTALS OF ORTHOPEDIC SURGERY IN GENERAL MEDICINE AND SURGERY** by *Robert B. Osgood, M. D., F. A. C. S., John Ball, and Buckminster Brown, Professor Emeritus of Orthopedic Surgery, Harvard Medical School, and Nathaniel Allison, M. D., F. A. C. S., Professor of Surgery in charge of the Division of Orthopedic Surgery, University of Chicago.* The Macmillan Co., New York, 1931. Price, \$3

This volume is a collection of the lectures presented to the last six classes of third-year students at the Harvard Medical School.

Convinced that the purely didactic lecture was "an inefficient method of imparting permanent knowledge," it was decided to present the subject in a manner that would stimulate more intimate contact between instructor and student.

In planning the material for these lectures the authors state:

The choice of subjects was determined by the conviction that in a 4-year medical course the student should be taught only enough of the recognized specialties of medicine and surgery to enable him to meet the demands of a general practice with intelligence and safety. We believe whole-class exercises in a specialty should include such teaching in the fundamentals as will enable a practitioner to make reasonably accurate diagnoses and recognize certain conditions which demand immediate appropriate treatment. Such exercises

should emphasize the important contacts of the specialty with general medicine and general surgery and should, of course, be supplemented by clinical work with small sections.

At the end of each lecture there are appended references for further reading.

**MODERN MEDICAL TREATMENT**, by *E. Bellingham-Smith, M. D., F. R. C. P., Lond., Physician and Lecturer on Medicine, St. George's Hospital, etc., and Anthony Feiling, M. D., Camb., F. R. C. P., Lond., Physician, Lecturer on Medicine, and Dean of the Medical School, St. George's Hospital, etc.* Volumes I and II. William Wood & Co., New York, 1931. Price, \$12.

During recent years the interest in diagnosis and the comparative neglect of therapeutics have been very pronounced. With this in view, in fact attributing the lessened interest in the art and science of therapeutics to "the ever-increasing demands made upon the time of the student and practitioner by pathological investigations and by refinements and complexities of modern diagnostic methods \* \* \*," the authors have written this new *Modern Medical Treatment*.

The method of presenting the subject is well described by the authors:

The subject of therapeutics is presented here from the aspect of the disease concerned and not from that of the remedies employed. In order, however, to furnish a more rational description of the general management of the patient, it has been thought desirable to include not only details of the actual treatment but also brief summaries of etiology and symptoms, as well as of any complications for which special therapeutic measures may be required. Questions of prognosis have also been considered in so far as they affect treatment.

While every attempt has been made to include the numerous recent advances in therapeutics, we have not recommended any forms of treatment of which the value is still problematical. Our personal experience has throughout been the foundation of our recommendations. While the older established measures are described, it has also been our aim to do full justice to more recent methods, such as the use of sera, vaccines, and the many different kinds of physical treatment which are now so widely employed.

Volume I consists of 622 pages and discusses the treatment of the diseases of the nervous system; diseases of the heart; diseases of the blood vessels; diseases of the blood, spleen, and lymphatic glands; diseases of the endocrine glands; diseases of the respiratory system; and diseases of the kidneys and urinary tract.

Volume II has 626 pages and discusses the treatment of the diseases of the alimentary canal, diseases of the liver, disorders of metabolism, intoxications, diseases of the joints and muscles, and infectious diseases.

An unusually complete index of the entire subject is given in both volumes.

**A TEXT-BOOK OF CLINICAL NEUROLOGY**, by *Israel S. Wechsler, M. D., Professor of Clinical Neurology, Columbia University, New York, etc.* Second edition. W. B. Saunders Co., Philadelphia, 1931.

In view of the progress made in the field of neurology since the appearance of the first edition of this book five years ago, a careful revision has been necessary to bring the subject abreast of the times. As the author states:

The subject of encephalography has undergone considerable growth, the pathology of tumors of the brain has been studied rather intensively, the epilepsies have been the subject of much research, and numerous other contributions have been made which merit attention.

The original plan of dividing the text into five parts has been adhered to, namely, method of examination, the spinal cord, the peripheral nerves, the brain, and the neuroses.

Parts of the text, however, have been rearranged. Tabes and syphilitic meningomyelitis have been taken from the diseases of the spinal cord and included under syphilis of the nervous system; the cerebral have been classified with the peripheral nerves; multiple sclerosis has been shifted; the degenerative syndromes and the inflammatory diseases have been grouped in a more consistent relationship; in general the Oppenheim classification, originally followed, has been departed from.

The subject is presented in a clear and concise manner and written in a most pleasing style.

The work comprises 758 pages, including the index, and contains 142 illustrations.

**DIAGNOSIS OF NERVOUS DISEASES**, by *Sir James Purves-Stewart, K. O. M. G., C. B., M. D. Edin., F. R. C. P., Senior Physician to Westminster Hospital, Physician to the Royal National Orthopaedic Hospital, etc.* Seventh edition. The C. V. Mosby Co., St. Louis, 1931. Price \$11.

The fact that this work has reached its twenty-fifth year and is now published in a seventh edition attests its value as a textbook for the student. This can certainly be attributed to the author's very distinct departure from the conventional pattern of neurological textbooks. In fact, he states in the preface—

For the information of new readers I would here explain why the arrangement of subjects in this book is unlike that of a systematic textbook which discusses the phenomena of each disease in turn. In clinical practice we find that it is unusual for a patient to present himself with his disease already diagnosed. More commonly he comes complaining of symptoms which are consistent with several diseases. In such circumstances a work like this may be helpful by indicating how to discriminate between different diseases which present similarities in their symptoms and signs.

The aim throughout the book has been to present “\* \* \* a convenient picture of current clinical neurology, serving as an

introduction or supplement to the more elaborate systematic treatises \* \* \*."

The text consists of 700 pages and is illustrated with 312 well-selected figures.

ALLERGY AND APPLIED IMMUNOLOGY, by *Warren T. Vaughan, M. D., Richmond, Va.* C. V. Mosby Co., St. Louis, 1931. Price, \$4.50.

Doctor Vaughan, an authority on the subject of which this volume treats, has produced a book which contains about all a general practitioner need know in regard to allergy in order that he may be competent to diagnose and treat his patients satisfactorily.

The book is divided into seven parts. Part I describes the nature of allergy and how it affects the individual. Part II treats of the substances (allergens) which provoke symptoms. Part III gives the methods by which we determine the causes of an allergic patient's illness. Part IV discusses the measures taken to secure relief. Part V tells of what results we may expect from treatment. Part VI gives the symptoms that may be associated with allergy. Part VII discusses other diseases in the treatment of which allergic or immunologic principles are employed. An extension bibliography of the subject completes the work.

HANDBOOK OF SKIN DISEASES, by *Frederick Gardiner, M. D., B. Sc. (Public Health), F. R. C. S. E., F. R. S. E., Lecturer on Skin Disease, University of Edinburgh; Physician for Diseases of the Skin, Royal Infirmary, Edinburgh.* Third edition. William Wood & Co., New York, 1931. Price, \$3.50.

A compend on diseases of the skin. The diseases more commonly encountered are considered and their treatment discussed in an unusually practical manner. A handy little volume for both the general practitioner and the medical student.

PRACTICAL MORBID HISTOLOGY, by *Robert Donaldson, M. A., M. D., Ch. B. (Ed.), F. R. C. S. E., D. P. H., Sir William Dunn, Professor of Pathology in the University of London, etc.* Second edition. The C. V. Mosby Co., St. Louis, 1931. Price, \$12.

A handbook of morbid anatomy, written by an experienced teacher, and planned for the needs of the student.

As stated in the preface:

The choice of subject matter has been largely governed by the range of material usually provided for students in the classes of morbid histology in the medical schools of Great Britain. No attempt has been made to give an exhaustive account of all possible lesions which may be met with in the human body, and, as far as possible, reference to purely theoretical considerations has been omitted. The latter are thoroughly dealt with in the standard textbooks of general pathology to which this volume is merely ancillary.

The descriptions of the gross and histological appearances of the various lesions are given in a very concise and clear manner.

The 214 illustrations have been selected with care and enhance the value of the work.

A chapter on histological methods and appendices, with useful information on stains and tables on helminthic parasites and their ova, complete the text.

**SIMPLIFIED DIABETIC MANAGEMENT**, by *Joseph T. Beardwood, jr., A. B., M. D., F. A. C. P., Chief of Diabetic Clinic and Associate Visiting Physician, Presbyterian Hospital in Philadelphia, etc., and Herbert T. Kelly, M. D., F. A. C. P., Associate in Diabetic Clinic, Presbyterian Hospital in Philadelphia, etc.* Diets prepared with collaboration of *Elsie M. Watt, A. B.* J. B. Lippincott Co., Philadelphia, 1931.

This little manual of less than 200 pages is of exceptional value as a reference in the practical management of diabetics. It is perhaps of even greater value to the diabetic than to the physician, since the diet tables and the text are presented in a manner of commendable simplicity, and thus availability, for patients of average intelligence.

The "unit measurement" system, the "diet prescription chart" and the numerous "specimen diets" presented here will prove of extreme convenience and service to both patient and physician.

The book is compiled by two authorities of high ability and standing, who have limited the text and tables to matters strictly of practical concern.

The three divisions of the book are: I, General Considerations; II, Modern Conception and Diagnosis of Diabetes; III, Unit Method Charts.

**LIVING THE LIVER DIET**, by *Elmer A. Miner, M. D., Independence, Kansas.* The C. V. Mosby Co., St. Louis, 1931. Price \$1.50.

A small manual written primarily for the patient suffering from pernicious anemia. The Minot-Murphy diet is used as a basis and a number of useful recipes, hints, and suggestions in connection with the liver diet are given.

The book consists of 102 pages and is of convenient pocket size.

**METALLURGY FOR DENTAL STUDENTS**, by *Kenneth W. Ray, Ph.D., Associate in Metallurgy, Department of Chemistry, University of Iowa.* P. Blakiston's Son & Co., Philadelphia, 1931.

This small volume incorporates the material given to the classes in dental metallurgy at the State University of Iowa.

The subject matter is divided into three parts. Part I gives a brief discussion of the principles of physical metallurgy and metallography. Part II takes up the metallurgy of the common metals. Part III discusses the properties of dental materials.

A practical laboratory outline and an appendix with useful conversion tables completes the work.

**ELEMENTARY BACTERIOLOGY AND PARASITOLOGY FOR THE USE OF NURSES**, by *Herbert Fox, M. D., Director of the William Pepper Laboratory of Clinical Medicine in the University of Pennsylvania, etc.* Fifth edition. Lea & Febiger, Philadelphia, 1931. Price, \$2.50.

Since the appearance of the fourth edition of this excellent textbook in 1926 the text has been extensively reedited and new material added. A more complete discussion is given of the working of the microscope, a method for the bacteriological control of the surgical operating units, skin tests, bedside collection of specimens and blood typing. The chapter on animal parasites has been completely revised and enlarged. That this book has reached its fifth edition attests its favorable reception by the nursing profession.

**THE NURSE'S MEDICAL LEXICON**, by *Thomas Lathrop Stedman, A. M., M. D., Editor of the Twentieth Century Practice of Medicine, of the Reference Handbook of the Medical Sciences, etc.* William Wood & Co., New York, 1931. Price \$2.

A volume of convenient size containing medical terms, alphabetically arranged, the definitions of which will be found instructive by members of the nursing profession, premedical and dental students, physicians' and dentists' office assistants, and Red Cross and public-health workers. In an appendix useful tables and information are given on the following subjects: Weights and measures, temperature scales, poisons and antidotes, and infectious diseases.

**THE MEDICAL CLINICS OF NORTH AMERICA, NOVEMBER, 1931.** W. B. Saunders Co., Philadelphia, 1931.

This number contains contributions from the leading clinics in Chicago.

The first paper is by Drs. Arthur R. Elliott and Richard H. Young, who discuss the effects of radiation therapy in myelogenous leukemia. In conclusion they state in part—

that in concurrence with Isaacs' views our experience with the four cases herewith reported indicates that Röntgen irradiation appears to stimulate the rapid division of the myeloblasts with coincident or resulting depression of the whole hematopoietic system. In cases where there is a favorable differential blood picture characterized by an absence or very low percentage of primitive cells the patient may be benefited by properly regulated X-ray dosage. Myeloblastosis, thrombocytopenia, purpura, progressive anemia, pyrexia, all pointing to an active disease process, constitute arguments against therapeutic irradiation.

Dr. Charles Spencer Williamson has contributed an interesting paper on Banti's syndrome and allied conditions. He is of the opinion that—

\* \* \* from the therapeutic standpoint every case with a reasonably well-founded diagnosis of Banti's disease is better off for a splenectomy. In many of

the cases it really accomplishes a great deal. In some it seems to be curative, and should you run into an exceptional case of Hodgkin's limited to the spleen, as in our last patient, the removal of this organ has the advantage at least that it removes a very unpleasant foreign body, for that is what it really amounts to.

Dr. Robert W. Keeton discusses "some things every physician should know about diabetes."

Dr. James G. Carr reviews two cases of staphylococcic septicemia with meningitis.

Among the other interesting papers are: Ulcers of the Stomach and Duodenum, by Dr. Sidney A. Portis; Gall-Bladder Disease, by Dr. Edmund F. Foley; Syphilis of the Heart, by Dr. Robert S. Berghoff; and Gastric Hypoacidity, by Dr. Michael Heny Streicher.

THE SURGICAL CLINICS OF NORTH AMERICA, October, 1931. W. B. Saunders Co., Philadelphia, 1931.

The clinics in this number have been contributed by members of the Pacific Coast Surgical Association.

The first paper is by Dr. Rexwald Brown, who, in discussing carcinoma of the pancreas, makes the following comments in connection with the Coffey-Humber extract in the treatment of carcinoma:

In a series of autopsies on carcinoma cases dead after the Coffey-Humber extract has been given, posted in the Cottage Hospital, no marked changes in carcinoma tissue suggestive of regression were found. Research investigation in the Cottage Hospital on a series of cases of rat sarcoma demonstrated that those treated with the Coffey-Humber extract as contrasted with the controls not so treated showed like results, i. e., the usual changes which occur in malignancy.

Unquestionably certain malignant conditions, especially those on the external surface of the body, have shown regression and even disappearance under the Coffey-Humber extract. This, however, can not be called cure in any larger sense than the regression and disappearance of carcinoma under radium, X ray, lead, other extracts, and even spontaneous regression can be called cure. The Coffey-Humber extract is one of a large number of agents which not infrequently cause recessive changes in certain types of carcinoma.

The other papers, too numerous to list, discuss various phases of surgical practice.

THE SURGICAL CLINICS OF NORTH AMERICA, December, 1931. W. B. Saunders Co., Philadelphia, 1931.

This is a Philadelphia number of the Surgical Clinics and contains a number of interesting papers by well-known members of the profession; among them the late Dr. John B. Deaver, Dr. Chevalier Jackson, and Dr. W. Wayne Babcock.

As usual, there is a wide variety of surgical topics, including hernia, fractures, head injuries, varicose veins, and malignancy of various organs. This number contains the index to volume 11 of the Surgical Clinics.





## THE DIVISION OF PREVENTIVE MEDICINE

O. J. MINK, Captain, Medical Corps, United States Navy, in charge

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### AMMONIUM ORTHO-IODOXY-BENZOATE IN THE TREATMENT OF ARTHRITIS

REPORT OF CASES SHOWING THE ACTION AND TOXIC EFFECT OF THE DRUG, INCLUDING A CASE OF FATAL POISONING, WITH GENERAL COMMENT ON THE SUBJECT AND A REVIEW OF THE FATAL CASE

By W. H. BELL, Captain, Medical Corps, United States Navy, and PAUL RICHMOND, Jr., Lieutenant Commander, Medical Corps, United States Navy

The following is a report of recent experience with this treatment at the United States naval hospital, Mare Island, Calif. The cases under discussion were in the ward in charge of H. H. Carroll, lieutenant (junior grade), Medical Corps, United States Navy. The one case of death following administration of the drug is naturally given prominent position in the report. The preparation used was that manufactured by a well-known and reliable house and offered to the market under the trade name "amiodoxyl benzoate."

#### CASE REPORT AND COMMENT BY HOSPITAL

The death referred to occurred June 8, 1931. The patient was a machinist's mate, first class, 30 years of age. He was suffering from chronic arthritis of the cervical spine, elbows, and knees, of four years' duration. Both hips became involved about three years ago. He was admitted to this hospital March 14, 1931, and was found to have considerable limitation in the movement of his jaw. Rotation and flexion of the neck were limited, and in the dorsal region the spine was practically fixed. The left knee and right ankle joints were enlarged. A soft systolic murmur was heard over the apex of the heart. X-ray examinations revealed nothing but evidence of bony roughening and lifting of periosteum about the internal malleolus of the right ankle.

He was carefully examined for possible foci of infection, but none was found. He was treated with salicylates, sodium bicarbonate and potassium iodid, as well as various physiotherapy measures, without definite benefit.

He was examined by a board of medical survey, May 11, 1931, and recommended for discharge from the service by reason of chronic arthritis resulting in permanent disability. As a result of consultation in his case it was decided to try the effect of amiodoxyl benzoate. One gram of the preparation was administered intravenously May 18, 1931, by gravity, dissolved in 100 c. c. of physiological salt solution which was prepared with distilled water. The introduction time was 12 minutes. The injection was not followed by any noticeable reaction.

On May 26, 1931, he was given a second dose of 1 gram with similar technique and the same precautions. One hour after the injection he had a slight chill and his temperature rose to 100.8° F. in the evening, but no effect was manifest the next morning.

On June 3, 1931, he received a third injection of 1 gram with similar technique and precautions. The time during which the 100 c. c. solution containing the amidoxy benzoate was introduced into the blood stream was between 12 and 15 minutes. About half an hour after the injection he had a chill. During the night his temperature rose to 105° F. and the pulse rate to 158. He vomited several times during the night and next morning. He was then very restless and felt dizzy and weak. A considerable degree of shock was evident. At noon his blood pressure was 60/40.

He had two ulcerated internal hemorrhoids and had bled from them occasionally for three or four months. When the amidoxy benzoate reaction began his red blood count was about 3,000,000 and the percentage of hemoglobin was 55. Thirty-six hours after the last injection of amidoxy benzoate he was transfused with 300 c. c. of blood of his type. There was complete anuria.

The following morning—48 hours after the injection of amidoxy—400 c. c. of blood was transfused. This was followed by the intravenous administration of 900 c. c. of 10 per cent glucose solution containing adrenalin. This was followed shortly by a rise in the systolic blood pressure to 112, with the diastolic pressure 70. In the afternoon, 10 c. c. of gluco-calcium was given intravenously on account of anuria, no urine having been excreted during the preceding 48 hours. Diathermy was also given over the liver and through the kidney regions.

Seventy-two hours after the introduction of the third dose of amidoxy benzoate his blood pressure had fallen again to 70/40. His blood showed great retention of urea, nonprotein nitrogen, and creatinin. The small quantity of urine obtained by catheter contained a large amount of albumin with hyalin and waxy casts. Repeated intravenous injections of glucose solution were given. Anuria continued.

Ninety-six hours after the amidoxy benzoate injection the patient was semiconscious. About 100 c. c. of dark-colored urine was obtained by catheter. The urine was loaded with albumin and contained a few red blood cells, as well as hyalin and waxy casts and renal cells. One hundred and eighteen hours after the amidoxy benzoate injection twitching of facial muscles was observed. His temperature was then 106.2° F. by axilla. He soon became comatose. Lumbar puncture was performed and 90 c. c. of cerebrospinal fluid ran out under increased tension. The fluid had a yellowish tinge and contained 3.2 mg. of creatinin and 225 mg. of nonprotein nitrogen per 100 c. c. A cell count was not made. A few hours later his coma deepened and pulse and respirations grew weaker. He died about 124 hours after the third injection of amidoxy benzoate, which is regarded as an essential cause of damage to liver and kidneys resulting in death.

*Post-mortem findings were as follows:* On each heel and on the left elbow there was a purpuric spot, 5 by 8 cm. There was a similar spot on each buttock. Each pleural cavity contained 250 c. c. of thin fluid, reddish in color. The upper lobe of the right lung was grayish in color and crepitant throughout. The lower lobe was reddish in color and on section showed a reddish oozing surface throughout. The inferior portion of the lower lobe of the left lung was similarly affected. The pericardial cavity contained about 300 c. c. of amber-colored fluid.

The heart was somewhat enlarged transversely. On section, the wall of the right ventricle was thin and pale. There was a large blood clot in the right ventricle, firmly attached to the wall and valves. Roughened fibrotic areas, millet seed in size, were found on the edges of the mitral valve. The aorta and coronary vessels appeared normal. The spleen was enlarged, weighed 240 grams, and was purple in color. There were a few small grayish-white areas under the capsule.

The liver was greatly enlarged. It weighed 2,100 grams. There were several dull red spots, 1 mm. in size, scattered over the surface. On section, uniform minute punctate red spots were revealed throughout the liver substance.

Both kidneys were enlarged, weighing 340 grams each. The capsules stripped with difficulty. The medullary tissue was pale. The medullary-cortical ratio was about 2 to 1. There were minute hemorrhagic areas in the cortex of the left kidney.

From macroscopic evidence the following conditions were regarded as established: Acute hemorrhagic hepatitis, cloudy swelling of both kidneys; acute glomerular nephritis of the left kidney; acute splenitis; multiple old infarcts of the spleen; hypostatic congestion of the lower lobes of both lungs; slight fibrosis of the mitral valve of the heart; purpura of both heels, buttocks, and left elbow. The brain was not examined.

The immediate cause of death was regarded as acute hepatitis and acute nephritis induced by toxic action of amiodoxyl benzoate.

During the past year three patients have been treated with amiodoxyl benzoate at this hospital. The first patient was given large doses of sodium salicylate on board the U. S. S. *Chaumont* before transfer to this hospital and had acute gastritis upon admission. On the second or third day after arrival here he was given 1 gram of amiodoxyl benzoate intravenously, and within a few hours he was suffering from the effects—high fever; continuous retching and vomiting; rapid, weak pulse; and very low blood pressure. Acidosis developed and he was regarded as critically ill, but gradually recovered after a period of several weeks.

The second patient, one with chronic multiple arthritis, not venereal in origin, was given a series of six intravenous injections of 1 gram each, without any particular benefit and without any manifestation of toxic action.

The third patient was he whose case is described in detail above.

Inquiry into the use of amiodoxyl benzoate by physicians of San Francisco and by those connected with the Woodland clinic, Woodland, Calif., brings us the information that about 75 cases of arthritis have been treated with amiodoxyl benzoate during the past four years in the Woodland clinic. As a rule, the dose has been 1 gram administered intravenously. The patients usually received several courses of six to eight injections each, the drug being administered in most cases twice a week, but in some as often as every other day. Several hundred injections have been given in that clinic and the chief of the medical service stated that no serious reaction has occurred at their hands. The technique of preparation and administration has been the same as that followed in our hospital. Variable results have been obtained at Woodland. Striking improvement has been noted in some cases, especially relief from pain in severe cases of infectious arthritis. As a rule, other measures are tried first in that clinic and amiodoxyl benzoate is used after other treatments have failed, but that is not always the case and certain patients have been given that drug at once. The experience in the Woodland clinic has been such as to lead the physicians there to continue the use of the drug as a valuable adjunct in the treatment of arthritis.

In San Francisco hospitals it appears that about 170 patients have been treated with amiodoxyl benzoate in four hospitals, and in addition that Doctor Mettler, of the University of California Medical School, who worked with Doctor Young in Boston while amiodoxyl benzoate was being used freely, has treated many patients with the drug. Doctor Mettler, in several cases, has noted liver damage, chills and fever, and vomiting, but has not personally seen a fatal case of poisoning by the drug. One woman patient developed leukopenia, severe pericarditis, and pneumonia. At other hospitals in San Francisco burning sensations of the mucous membranes of the mouth and eyes have been noted following intravenous injections of amiodoxyl benzoate. Skin rashes have been noted in a number of cases. One case of renal damage has been observed in that city, but so far as can be ascertained, no death attributable to the drug has occurred in San Francisco or other bay cities. Opinions regarding the therapeutic value of this iodine compound are about the same in San Francisco as at the Woodland clinic.

We know of two deaths attributed to iodoxyl benzoate besides the one we are now reporting. The first was reported by Manace (1) and the second by Baird, Fitzgibbon, and Rosenfeld (2).

Summaries of these reports follow. It is quite possible that other deaths, in reality caused directly or indirectly by amiodoxyl benzoate, have not been recorded in medical literature.

*Case reported by Dr. Bernard A. Manace: History.*—The patient, a single woman of 57 years, weighing about 90 pounds, was admitted to the medical ward on September 2, 1927, complaining of swelling and pain in the joints, and presenting marked deformities.

*Course in the hospital.*—On September 27, 1927, at 3 p. m., the patient was given 100 c. c. of 1 per cent "amiodoxyl," using one of the small veins on the dorsum of the hand. The time required for administration was 35 minutes. No apparent reaction followed, even the usual complaints of discomfort being absent. The patient was next seen by the interne at 7 p. m., and nothing in particular was noted until about 10 p. m., when she complained to the nurse about not feeling well. A few minutes after this she seemed irrational and her pulse became weak and thready. At 10:10 p. m. she quietly expired.

*Post-mortem findings:* Microscopically all the blood vessels of the brain, (meningeal, basal, choroidal), were considerably engorged. The meninges showed no thickening or exudate. The brain substance was edematous and quite soft. No evidence of hemorrhage or thrombosis was found in any portion. The lungs, on cut section, revealed extensive congestion, more so on the right, but no definite pneumonic process was present. The liver and intestinal mucosa were markedly congested. Microscopically, the above gross central nervous system findings were corroborated. The lungs were the seat of a marked acute exacerbation on a chronic congestion, associated with edema. Many small hemorrhages by diapedesis were noted. Advanced sclerosis involved the aorta, aortic valves, and coronaries. The abdominal viscera showed chronic passive congestion. The cartilages of the knee joint were considerably eroded, being replaced by granulation tissue, with some areas of organized fibrin. A chronic productive perichondritis with periostitis was present. The vertebrae showed osteoporosis with excessive fatty marrow and some atrophy. Examination at the site of injection failed to reveal any thrombosis or inflammation.

*Comment (summarized):* 1. First fatality which has been reported following the intravenous use of ammonium ortho-iodoxy benzoate. 2. The drug should be used with discretion. 3. Such a fatality might have been avoided if the initial dose of the drug had been small; i. e., 0.5 gm. 4. Subsequent doses

should be increased with caution. 5. This fatality has occurred after several hundred administrations of the drug in this hospital, and for that reason does not contraindicate its use in the presence of evidence for its marked beneficial action. However, it does serve to demonstrate that size of dose to a given patient should receive due consideration.

*Case reported by Drs. D. W. Baird, J. H. Fitzgibbon, and A. S. Rosenfeld:*  
*History.*—Male, aged 66 years; was admitted to the medical department of the Multnomah County Hospital June 22, 1927. The patient was suffering from a chronic deforming arthritis of one year's duration. \* \* \*

*Treatment.*—Four injections (of ammonium ortho-iodoxy benzoate, 1 gram in 100 c. c. of normal saline solution) were given at 4-day intervals. Reactions were noted in about 10 minutes, consisting of a smarting sensation in the eyes with lachrymation, burning of the tongue, sneezing, slight salivation, increased pain, and burning in the joints. The duration of these reactions averaged about one hour \* \* \* (100 c. c. of a new preparation with the same technique were given). More severe reactions were noted than with the four previous injections. These reactions gradually became more distressing and were accompanied by abdominal cramps, vomiting, diarrhea, and increased pain in the affected joints. In two and a half hours after the injection the temperature was 101° F., by axilla; pulse, 124; respiration, 28. Restlessness and great anxiety was marked and headache became excruciating. The symptoms steadily increased in severity, and in spite of all efforts toward relief the patient expired eight hours after administration of the drug.

*Post-mortem findings.*—Marked edema of the brain; dilatation of the right heart; congestion of the lungs; marked hyperemia and congestion of the mucosa of the colon and the ileum; marked congestion of the mucosa of the stomach; chronic diffuse nephritis; cloudy swelling of the parenchymatous organs; chronic obliterative fibrous pleuritis, bilateral; fibrous splenitis; marked contractures of the hands; swelling of the knee joints.

*Summary and comments.*—1. Death appears to be the result of an overwhelming toxemia. \* \* \* It has been suggested and is, in our opinion, quite likely that, either in manufacture, administration, or decomposition of the drug in the blood stream, there was set free an intermediary toxic product which was responsible for the injurious effect observed.

#### RETROSPECT OF PHARMACOLOGICAL INVESTIGATION

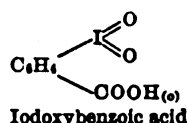
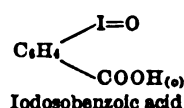
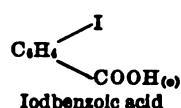
In the course of therapeutic research at the Pharmacological Laboratory of the University of Wisconsin, Loevenhart and Grove (3 and 4) inaugurated a study of the action of iod, iodoso, and oxyiodoso benzoic acids as long ago as 1908-9. Their preliminary report was communicated in June of the latter year. Their observation was quite definite that the oxygen bound to the iodine in iodosobenzoic acid did not act unassisted but did change phenolphthalin to phenolphthalein "in the presence of blood serum by furnishing oxygen for the peroxidase reaction"; that the "injection of minimal doses of N/100 solutions of sodium iodosobenzoate or oxyiodosobenzoate immediately and markedly depressed the respiratory center," which is "notably very sensitive to changes in the oxidative processes"; and that "oxyiodosobenzoic acid seems more powerful than iodosobenzoic

acid in producing the apnoea and also contains a higher percentage of active oxygen"—the one a consequent of the other, as antecedent.

In this connection "iodbenzoic acid was found to be entirely inactive in the doses employed," as would be expected in view of its relative chemical composition. As a point of interest Loevenhart and Grove note "that the taste of iodosobenzoate is indistinguishable from that of hydrogen peroxide" and they express the belief "that the very characteristic taste of both substances is due to the action of the active oxygen on the end organs of taste."

Based on the known dependence of the bactericidal effect of certain chemicals upon their reducing power (5), on interpretations of the results of previous experiments with benzoyl peroxide and on conceptions of practical usefulness, both to physiological research and to curative medicine, of findings in the early investigation of the above compounds, the quest was for an oxidising agent which would be at once physiologically active and safe for intravenous injections and could determine oxygen to the vital tissues for physiological oxidation through the agency of the oxidases, independent of the carrying reserve of the hemoglobin.

As Loevenhart and his associates point out, there are substances which without other effect decrease vital oxidation and the accompanying phenomena are known, but less is known of the important subject of physiological response to increased vital oxidation—i. e., the effects of increased physiological oxidation on the functions of cells and tissues. The need was for "compounds containing oxygen in a form which might be available physiologically" and those mentioned above as having been studied seemed to be of that nature. Sodium iodbenzoate is the mother substance and was used as a control. The formulas of the three acids are given as follows:



"Ortho iodbenzoic acid has long been known. Iodoso and iodoxybenzoic acids were first prepared by Victor Meyer and his co-workers." They are prepared from each other in the order named and the processes are fairly simple as are the tests for purity. The most important consideration in the preparation of iodoxybenzoate from iodosobenzoate is the degree of heat employed. "It may be rendered perfectly pure by a single recrystallization." When perfectly pure all these acids are white or practically so; and while the free acids themselves are insoluble, their salts are readily dissolved in water.

The authors point out that "the principal interest connected with the compound centers around the oxygen combined with the

iodine," which because of its ready liberation makes them highly oxidizing and which when liberated yields the inactive mother compound, iodbenzoic acid. They proved by a very simple experiment that the oxygen which these substances contain is available physiologically through the intermediation of hemoglobin, but they sought also "to determine whether or not the tissues themselves" could utilize this oxygen "in much the same manner that they utilize the molecular oxygen" derived from the oxyhemoglobin, and the probability of this was indicated by the phenolphthalin experiment, showing that a substance which does not yield oxygen in ordinary chemical reactions may still be utilized by the cells for physiological oxidation.

The local and blood effects of these substances and their action upon the circulation and respiration as observed by Loevenhart and Grove are interesting, but as they vary in both nature and degree a summary is difficult.

The local action is dependent upon the degree of acidity so that iodbenzoic acid is only slightly irritating, iodosobenzoic acid is bland, and iodoxybenzoic acid is quite irritating, but this relativity is changed when the acid radical is displaced by a salt. With the sodium salt the action of iod and iodoxy benzoic acid is mild; that of iodosobenzoic acid "is extremely irritating when injected subcutaneously or intraperitoneally." When injected intravenously sodium iodoso and iodoxy benzoate are not destructive to the blood but produce a moderate leukocytosis.

On the circulation, sodium iodbenzoate has only a slight effect and that is in the direction of causing a rise of arterial blood pressure, but the reason for this is not known. Sodium iodosobenzoate on the other hand causes a marked and prolonged fall of blood pressure, but the heart rate and amplitude are only slightly affected. The action of iodoxybenzoate is similar to though less marked than iodosobenzoate and may cause a rise of blood pressure.

On the respiration, iodbenzoate does not affect the rate or depth of respiration. Sodium iodoso and iodoxy benzoate have about the same effect, depressing respiration and in animals producing apnoea of varying duration. The respiratory is the most sensitive of medullary centers. "The vasomotor center is next and the cardio-inhibitory center is not affected by them." The remarkable effect of these compounds on the respiratory and vasomotor centers is believed due to the available oxygen combined with the iodine, operating in some such manner as decreasing the need for the pulmonary supply.

The employment of ammonium ortho-iodoxy-benzoate in the treatment of the arthritides and certain associated rheumatic conditions definitely passed the clinical experimental stage some time ago though its manner of action is not yet known and its use is empirical.

Based on the observation of a germicidal action (5)<sup>1</sup> of ortho-iodoxy-benzoic acid after "it was first described by Victor Meyer and his coworkers in 1892," Young and Youmans introduced and employed it in the treatment of infectious arthritis. Their series of cases was reported in 1926 and the results noted by various other clinicians, as recorded in medical literature following this first report, led to widespread use of the drug. Experience with it has not been entirely uniform, but on the whole the curative effects have been sufficiently encouraging in dependable opinion to regard it as a possible therapeutic resource in the trying and refractory class of diseases represented by the arthritides. It is described in New and Nonofficial Remedies and has in fact found place in Beckman's Treatment in General Practice (1930).

At first the acid preparation was used; but although no deaths seem to have occurred, the reactions were so severe that in 1927 a shift was made to the salts and the ammonium ortho-iodoxy-benzoate is the usual form in which it has been used ever since. In the vast majority of cases intravenous injection has been the method of administration and the quantity, dilution, and technic have been standardized. Only two previous deaths ascribed to the drug are on record in medical literature as noted in the above report, one in 1928 and one in 1930, which in view of the hundreds of cases so treated (exact number not known) gives a very small mortality incidence. Indeed, the treatment has been regarded as so devoid of risk that it has been administered to numerous ambulatory cases in outpatient clinics.

The cause of the two accidents was a matter of conjecture. A number of pharmaceutical establishments produce the drug, and by some pharmacologists its synthesis is considered so simple and its composition so stable that impurities or intermediary substances occurring in the process of manufacture are thought unlikely. However, this is not of general belief or to be taken as final. Its action and the pathological findings in these reported fatal cases are said to have suggested an overwhelming intoxication, but whether this effect was due to the particular preparation of the drug per se consequent upon pH concentration or an undetermined variation in

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<sup>1</sup> In a study of their antiseptic value in vitro (*B. typhosus*) the substance containing 1 atom of active oxygen is 100 times as bactericidal as the mother substance containing no active oxygen; the substance containing 2 atoms of active oxygen is twice as bactericidal as that containing 1 atom of active oxygen.



arrangement of the chemical elements or to the inclusion of some foreign element such as an iodoso compound or to some other factor in the nature of an unpredictable idiosyncrasy remained undetermined by their studies.

In this connection the pharmacologic report on the preparations used in the cases discussed by Baird, Fitzgibbon, and Rosenfeld (2) is interesting and suggestive:

*Pharmacologic report.*—Samples of the two preparations used in our treatment of the above cases, were submitted to Dr. Harold B. Meyers, professor of pharmacology, department of medicine, University of Oregon, for analysis. His results are expressed in the following communication:

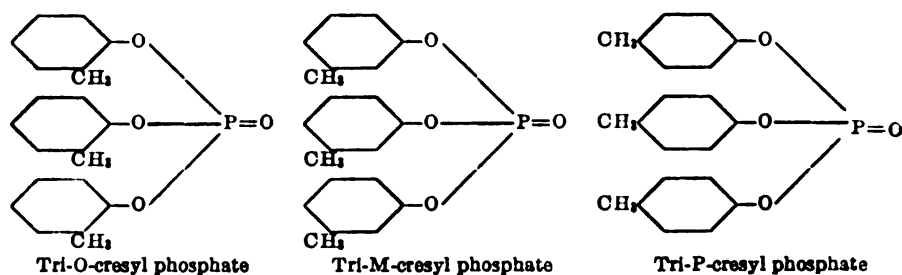
"We wish to acknowledge receipt of the two preparations of ammonium ortho-iodoxy-benzoate hereinafter referred to as preparation A and preparation B, the latter having caused the toxic reactions described by you.

"The hydrogen-ion concentrations of 1 per cent solutions of both salts show that preparation B has a pH of 5.35 and preparation A a pH of 5.75. The slightly greater acidity of preparation B might play some part in the toxic reaction. It is unlikely that the difference in hydrogen-ion concentration would account for more than a minor part of the difference in toxicity of the two preparations, considering that 1 gram was the total amount of drug injected and that it was given slowly as 1 per cent solution.

"Experimental animals injected intravenously with 1 per cent solutions of preparations A and B in isotonic saline with buffer salts to equalize difference in hydrogen-ion concentrations, show that preparation B has a much more pronounced toxic effect than preparation A. These salts were injected in 1 per cent solution at the rate advised for human administration in dosage of 14.3 mg. per kilo, which is the concentration for an adult of approximately 150 pounds weight. The animal injected with preparation B stopped breathing, lay apparently lifeless, and had very feeble heart action for some time following injection. Symptoms indicating possible fatal results occurred before the injection was completed.

"Some have asked if the iodine content of the salt might account for the toxic reaction. It is improbable that the iodine liberated as iodine from the salt could account for the toxic results because the minimal fatal dose of iodine is larger than the total amount of iodine contained in the salt. It is my belief that the toxicity is due probably to an intermediary substance prepared in the process of manufacture, such as an iodoso compound, which is relatively highly toxic."

The point is that in employing complex compounds such as that under discussion and the arsphenamines, etc., we are dealing with what is potentially harmful for one reason or another, either as represented by the therapeutic agent itself or by the organism under treatment. For example, the triorthocresyl phosphate found to be the poisonous factor in some specimens of "adulterated fluid extract of ginger used for beverage purposes" (6) is one of a group of compounds known as phenol esters, the only difference between the ortho-combination (the poisonous substance) and the meta or para combinations (the harmless substances) being the position of the methyl group in the phenol ring of the structural formulas as shown on following page.



In turn, it is upon the position of the methyl group in the phenol ring that the physiological action of these compounds depends. Comparably, as regards the organism subjected to the effect of a given compound, we may read into the result a similar dependence upon the position of a specific pathological susceptibility. The compound itself may be harmless to the individual whose vital organs, particularly those concerned with elimination, are sound. But any disturbances in the vital ring, so to speak—i. e., any depression of function by disease of one of the vital organs—constitutes a weak area in low or no reserve for the handling of foreign substances, and it breaks down under the sudden or accumulating load with immediate or delayed symptomatology of varying severity according to the preexisting degree of tissue damage and functional impairment.

#### DISCUSSION AND APPLICATION OF THE EXPERIENCE AND STUDY

A review of the fatal case occurring at the United States naval hospital, Mare Island, Calif., and reported in detail above may develop considerations applicable to other cases either of severe reactions or fatal issue.

The administration of the drug in this case was according to safe practice. Therefore the severe reaction with a fatal issue may be assumed to have been due to some unusual condition of the patient at the time the drug was administered. Two previous injections without untoward reactions would eliminate the possibility of an idiosyncrasy to the drug.

In the past history of the present case the arthritic symptoms date from July, 1926. From then on the patient was under intermittent treatment and frequent observation with periods of apparent improvement with the usual steady progress of the disease. A systolic cardiac murmur was first noted March 11, 1929.

On December 30, 1930, a severe anemia was present and the case sent to Nanking University Hospital, Nanking, China. The symptoms referable to this condition had been present only two months. The r. b. c. dropped to 2,000,000 and the hemoglobin to 23 per cent. The w. b. c. remained normal. Marked loss of weight was noted (40 pounds). Palpable cervical and inguinal glands were noted.

Urinalysis showed a trace of albumin and pus cells. Infected teeth were noted and several removed. A blood culture was reported negative. A cardiac murmur was noted. The record is not complete. It contains no positive entry of fever, but under date of January 30, 1931, there is a statement that the temperature had been normal for the past 10 days. The w. b. c. was then 9,900. The patient had been given blood transfusions and later a cooked-liver diet. The anemia had improved and he was transferred on that date to the Canacao Hospital. No cause for the anemia is noted or suggested.

On admission to the Canacao Hospital on February 7, 1931, the r. b. c. was 4,800,000; hemoglobin, 70 per cent; w. b. c., 7,300; polys, 67 per cent. Other physical findings as before, except that cervical glands were not enlarged and hemorrhoids were first noted. No note is made as to whether hemorrhoidal bleeding had occurred and no operative treatment suggested. Patient was transferred February 18, 1931, and readmitted at Mare Island, March 14, 1931. In the admitting record of the hospital at this place it is stated that patient had had pain in rectum and bleeding with bowel movements for the past two months. Internal hemorrhoids were noted. No operative treatment was undertaken or suggested. Temperature varied from 98° F. to 100° F. A systolic heart murmur was present. Teeth suspicious of focal infection were noted. On April 15, 1931, r. b. c., 4,230,000. hemoglobin, 80 per cent; w. b. c., 7,400; polys, 59; lymphocytes, 39.

On May 1, 1931, a series of treatments for the arthritis with intravenous typhoid vaccine were noted as being continued. On May 18, 1931, the first amiodoxyl was administered, and on June 3, 1931, the third dose was administered. The patient died five days later with symptoms of uremia. The autopsy findings were as noted in the above report.

The sudden finding of existing anemia in December, 1930, without sufficient obvious cause would suggest that a severe focal infection with a septicemia might have been present at that time. The systolic murmur, noted first in 1929 and persistently present thereafter, suggests a subacute bacterial endocarditis. The associated signs, symptoms, and laboratory findings are noted above. The fact that a blood culture was made further suggests that the doctor in the Nanking University Hospital, in charge of the case at that time, suspected such a condition. The negative culture would not disprove the possibility of such having been present. At the Canacao Hospital in February, 1931, hemorrhoids were noted as being present, but no further statement was made concerning them. Not until the patient reached the Mare Island Hospital in March, 1931, was any bleeding

from hemorrhoids noted. The findings even then did not initiate operative measures, although the patient's blood picture had improved sufficiently to have made such treatment seem safe, if it had been considered necessary or desirable. No treatment of the hemorrhoids is recorded. It would seem improbable that such a severe anemia could have been due to the hemorrhoids without their attracting more attention. The gross autopsy findings indicate that a septicemia with damage to the heart, spleen, and kidneys had occurred at some time previous to the terminal toxemia. No microscopic examination of these tissues is recorded, but the roughened fibrotic areas on the mitral valve indicate the origin of multiple septic emboli. The small grayish-white areas under the capsule of the spleen must have been old healed infarcts from this source. From the findings of a trace of albumin and pus cells in the urine focal nephritis may also be assumed to have existed. The symptoms and urinary findings during this stage are often comparatively slight so that only by special tests and careful study of the urinary sediment is the serious impairment of function appreciated.

It is suggested that such damage to the kidney may have been present in this case to explain the onset of almost complete anuresis with retention of metabolites following what usually is a safe dose of this drug. If the reserve of kidney tissue, which is normally stated to be about 90 per cent of the total, had been markedly reduced without symptoms and more than slight urinary findings, which is entirely possible, the added reduction in the eliminative capacity of the kidneys incident to the tissue changes brought about by a reaction to the drug could have resulted in uremia.

The usually tolerated dose of such a drug indicates that the normal reserve capacity is present and marked temporary inhibition of function may pass unnoticed or at least clear up without a fatal outcome. The same would apply to the liver, which showed definite pathology in this case. The regenerative power of the liver, however, tends to minimize cumulative damage. Other vital parenchymatous organs may also be subject to such damage, but the symptoms of their loss of function would not be recognized.

This explanation of a possible cause of such a reaction as is recorded would suggest that before administering amiodoxyl benzoate or similar toxic drugs a complete study of the renal function by the more recently advocated methods (blood chemistry, blood urea clearance, phenolsulphonaphthalein, Addis cell, and cast counts or concentration and dilution tests) would add a factor of safety by assuring adequate kidney reserve. This would especially apply to those cases with a suggestive history.

Microscopic study of the autopsy material in this type of case would add valuable information.

The cause of death would seem to be more accurately described as severe reaction following intravenous medication with amiodoxyl, as the secondary or contributory cause, based upon a subacute bacterial endocarditis as the primary cause.

In other words, there was not an idiosyncrasy of indeterminable nature, but the probability of a susceptibility to the irritating qualities of the drug due to tissue pathology and impaired function of vital organs of elimination.

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- (3) Loevenhart, A. S., and Grove, W. E.: A preliminary note on the pharmacological action of iod, iodoso, and oxyiodoso benzoic acids. *J. Pharmacol. and Exper. Therap.*, 1:289, 1909-10.
- (4) Loevenhart, A. S., and Grove, W. E.: Studies on the pharmacological action of oxidizing substances. *J. Pharmacol. and Exper. Therap.*, 3:101, 1911-12.
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#### HEALTH CONDITIONS IN AMERICAN SAMOA<sup>1</sup>

REPORT OF THE HEALTH DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1930

##### PART II

By W. W. HARGRAVE, Commander, Medical Corps, United States Navy, Senior Medical Officer, United States Naval Station, Tutuila, Samoa

##### THE PERSONNEL OF THE HEALTH DEPARTMENT

Medical officers, United States Navy.....	3
Dental officers, United States Navy.....	1
Chief pharmacist, United States Navy.....	1
Chief pharmacist's mates, United States Navy.....	7
Pharmacist's mates, first class, United States Navy.....	2
Pharmacist's mates, second class, United States Navy.....	6
Pharmacist's mates, third class, United States Navy.....	6
Hospital apprentices, first class, United States Navy.....	1
Chief nurse, United States Navy.....	1
Nurses United States Navy.....	3
Chief Samoan nurse.....	1
Graduate Samoan nurses.....	17

<sup>1</sup> Part I appeared in the January, 1932, number of the BULLETIN. This second part concludes the report.

Undergraduate Samoan nurses.....	26
Native Hospital Corps man.....	1
Medical department fita fita.....	6
Samoan sanitary inspectors.....	2
Orderly, central public health laboratory.....	1
<b>Total .....</b>	<b>85</b>

#### DIVISION OF ADMINISTRATION, FINANCE AND SUPPLIES

The administrative and executive offices of the health department are located in the United States naval dispensary.

The present chief of the finance and supplies division is Chief Pharmacist V. M. Coulter, United States Navy, who reported here on June 11, 1930. As an official of the health department he is responsible for the procurement of all supplies and for the book-keeping of the health department and the United States Navy Medical Department of the naval station. He has supervision of all correspondence, files, dispensary, and store rooms and has direct supervision over the maintenance of equipment and issuing of expendable supplies.

This division distributes medical, surgical, and hospital supplies to the Samoan Hospital and to four district dispensaries. Due to the isolation of the villages in which these dispensaries are located, it is necessary to arrange for the packing and shipment of food supplies and mail, and to attend to other needs that may arise.

All administrative matters pertaining to the employment of Hospital Corps men and fita fitas assigned to the medical department are attended to by this division.

#### ALLOTMENTS : ISLAND GOVERNMENT FUNDS

	1930	1931		1930	1931
Salaries.....	\$5,649	\$6,061	Samoan nurses' supplies.....	300	250
Provisions.....	4,220	4,200	Equipment and supplies.....	1,300	960
Transportation.....	240	240	Special equipment.....	313	300
Laundry.....	430	400	Special diets.....	500	350
Electric current.....	384	384	<b>Total.....</b>	<b>13,736</b>	<b>13,545</b>
Maintenance of leper.....	360	360			
Printing.....	40	40			

#### EXPENDITURES : ISLAND GOVERNMENT FUNDS

	July 1, 1930, to Dec. 31, 1930	Jan. 1, 1931, to June 30, 1931		July 1, 1930, to Dec. 31, 1930	Jan. 1, 1931, to June 30, 1931
Salaries.....	\$2,593.83	\$2,628.22	Samoan nurses' supplies.....	\$73.61	\$152.24
Provisions.....	1,896.19	1,478.81	Equipment and supplies.....	496.81	380.97
Transportation.....	95.44	111.52	Special equipment.....	193.18	110.69
Laundry.....	115.92	58.90	Special diets.....	218.19	44.01
Electric current.....	186.18	184.03	<b>Total.....</b>	<b>6,212.44</b>	<b>5,166.89</b>
Maintenance of leper.....	333.09	0			
Printing.....	10.00	20.00			

Since the Public Health Department allotments are made on the 1st of January of each year, the expenditures covered by this report (from July 1, 1930, to June 30, 1931) must necessarily be those during the latter half of the 1930 allotment and those from the first of the 1931 allotment.

UNITED STATES NAVAL MEDICAL DEPARTMENT ALLOTMENTS (FOR THE FISCAL  
YEAR 1931)

71801 Medical Department, Bureau of Medicine and Surgery, 1931----	\$1, 605. 00
Naval medical supply depot, supplies and equipment, fiscal year 1931-----	15, 000. 00
<b>Total</b> -----	<b>16, 605. 00</b>

EXPENDITURES : UNITED STATES NAVAL MEDICAL DEPARTMENT

71801 Medical Department, Bureau of Medicine and Survey, 1931----	\$1, 433. 79
Naval medical supply depot, supplies and equipment, 1931-----	14, 125. 46
<b>Total</b> -----	<b>15, 559. 25</b>

RECAPITULATION OF EXPENDITURES

Island government allotments, July 1, 1930, to December 31, 1930----	\$6, 212. 44
Island government allotments, January 1, 1931, to June 30, 1931-----	5, 169. 39
Medical Department, Bureau of Medicine and Surgery, 1931-----	1, 433. 79
Naval medical supply depot, supplies and equipment, 1931-----	14, 125. 46
<b>Total</b> -----	<b>26, 941. 08</b>
<b>Total expenditures from all allotments for the maintenance and operation of the combined medical activities for the period July 1, 1930, to June 30, 1931-----</b>	<b>26, 941. 08</b>

INVENTORY OF EQUIPMENT AND SUPPLIES ON JUNE 30, 1931

Island government property, health department:	
Miscellaneous equipment-----	\$305. 91
Plant appliances-----	738. 14
Loose and hand tools-----	438. 35
Furniture and office accessories-----	648. 83
Medicines, etc. (expendable supplies)-----	177. 08
<b>Total</b> -----	<b>2, 308. 31</b>
Property belonging to the United States Navy furnished the health department:	
Surgical instruments-----	\$3, 237. 55
Surgical dressings-----	89. 64
Dispensary and laboratory equipment-----	1, 878. 07
Hospital and nursing appliances-----	2, 369. 81
Bedding and linen-----	1, 363. 83
Books-----	688. 52
X-ray equipment-----	7, 843. 22

Property belonging to the United States Navy furnished the health department—Continued.

Mortuary equipment.....	\$25.42
Dental operating room equipment.....	1,004.58
Dental instruments and appliances.....	378.20
Dental fracture and laboratory equipment.....	25.20
Field equipment.....	165.00
Office equipment.....	284.15
Miscellaneous equipment.....	3,034.70
Medical supplies (expendable).....	12,391.45
<b>Total.....</b>	<b>34,759.34</b>

The total cost was \$92,711.33, or \$9.285 per capita per year. The cost to the Samoan people was \$1.14 per capita and to the United States Navy, \$8.145. In regard to the high per capita cost of public-health work in these islands it should be borne in mind that the cost of hospitalization for all diseases and injuries is included; also, that there are no practicing physicians, dentists, or drug stores in the islands, and that all medical and surgical supplies are furnished to the Samoan people free of charge. Treatment of sick persons in their homes as well as in hospital is necessarily expensive. The per capita cost of health department activities here, such as those ordinarily carried on by official health organizations in the United States, is not high.

#### SPECIAL FUNDS IN CUSTODY OF THE PUBLIC-HEALTH OFFICER

Infant welfare fund with accrued interest in bank, June 30, 1930.....	\$166.09
Interest accrued to March 31, 1931.....	4.87
Funds contributed by U. S. S. Ontario players.....	15.25
Cash in safe.....	1.25
	<hr/>
	187.46
Cash withdrawals from bank.....	7.00
	<hr/>
Balance on hand June 30, 1931.....	180.46
Funds contributed by the Fagatogo Rugby Union, April 30, 1930.....	50.00
Expended May 14, 1931, for portable obstetric table.....	46.58
	<hr/>
Balance on hand June 30, 1931.....	3.42
Donation of Mr. George H. C. Reid, October 30, 1930 <sup>1</sup> .....	25.35
Expenditures.....	0.00
	<hr/>
Balance on hand June 30, 1931.....	25.35
Recapitulation:	
Infant welfare fund balance on hand June 30, 1931.....	180.46
Fagatogo Rugby Union balance on hand June 30, 1931.....	3.42
Donation of Mr. Reid balance on hand June 30, 1931.....	25.35
	<hr/>
Total of special funds.....	209.23

<sup>1</sup> The donation of Mr. George H. C. Reid, amounting to \$25.35, has been obligated for the purchase of a refrigerator for the Samoan Hospital.



## DIVISION OF VITAL STATISTICS

"No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring."

The present system of collecting vital statistics was put into effect by Commander J. R. Phelps, Medical Corps, United States Navy, and a special effort has been made to continue the high state of efficiency of this work. Some changes have been made in the manner of reporting filariasis, yaws, and tuberculosis in order to prevent duplication, and emphasis has been laid on accuracy and thoroughness on the part of personnel in the outlying districts.

The present chief statistician for the public health department of American Samoa is Chief Pharmacist's Mate John L. Inge, United States Navy. This department is now in possession of complete mortality and morbidity statistics for the years 1928, 1929, and 1930. If the collection of statistics had been along definite and consistent lines in the past, valuable data would now be at hand regarding the diseases prevalent in American Samoa which would prove extremely helpful in combating the incidence of these diseases and in reducing economic loss to the Samoan people. The statistics compiled during the past three years are proving their worth at the present time.

The responsibility of collecting statistical data in the field rests with the various district health officers and their assistants. This data is then forwarded to the central office, where it is checked and tabulated. To insure the proper reporting of all births and deaths and to secure the collection of information from which causes of death might be deduced, a system applicable to the peculiar conditions and circumstances was devised and communicated to all concerned. Instruction covering the method of collecting and reporting statistical data is at present a principal course in the curriculum of the training school for native nurses.

Now that the division of vital statistics has become so firmly established it is hoped that its important function in a modern health department will not suffer from neglect. To carry it on, the services of a chief pharmacist's mate who has had the necessary training in the statistical method is required. An experienced statistician is as essential to the organization as a qualified laboratory or X-ray technician.

## DIVISION OF PUBLIC HEALTH NURSING

The Samoan Hospital Training School for Nurses was founded in 1914. Since that time it has undergone a gradual expansion and change in curriculum and methods of instruction in order to meet the

nursing conditions in the field that fall upon the graduates of this institution.

The chief of this division is Chief Nurse Mildred R. Beat, United States Navy. Miss Beat is the superintendent of the Nurses' Training School and chief nurse of the Samoan Hospital, and her other duties are as follows: Supervision of the nursing and care of the patients in the hospital; executive duties in connection with hospital supplies; food supplies; inspection and upkeep and supervision of the Samoan nurses' mess; and the special diets of the patients.

The course of training in the school extends over a period of four years. The students receive daily lectures given by the chief nurse, the public-health officer, the medical director of the Samoan Hospital, the junior medical officer, and the chief of the laboratory division. Practical instruction is given by the assistant Navy nurses, the chief Samoan nurse, the pharmacist's mate in charge of the hospital dispensary, and the pharmacist's mate in charge of the hospital laboratory.

The beginners are recruited, as a rule, from the schools of American Samoa. An endeavor is made to select only those who possess a high moral character and those who have reached a scholastic attainment commensurate with the requirements of the training school. A good working knowledge of English is essential. The average student nurse upon entrance has reached the sixth or seventh grade. During the first three years of training the nurses are given a daily course of lectures covering the fundamental subjects—*anatomy, physiology, obstetrics, and principles of nursing*, and to a lesser extent *bacteriology, materia medica, and laboratory instruction*. During the same period they receive practical instruction at the bedside and in the clinics. Throughout their course of training they carry on the actual nursing of the patients in the hospital under the guidance of the Navy nurses. During their last year the senior class receives intensive instruction in *history taking, preventive medicine, clinical diagnosis, treatment of local diseases, and instruction covering the method of collecting and reporting of statistical data in the field*.

It is gratifying to me to note, in my daily contact with them, the amount of knowledge that they have acquired. This is significant when you consider the momentous task that confronts them in undertaking the study of nursing with a limited knowledge of the English language and in having to deal with the entirely new vocabulary that is found in medical and nursing subjects.

The graduate nurse upon the completion of the four years' course of training enters a new field of work as a member of the public health department. Two graduates are kept on duty at the Samoan Hospital and the others are sent to the outlying dispensaries, where their chief duties are in the villages and homes of their own people.

The visits that these nurses make to the various villages carry them over difficult trails and considerable distances from the dispensary. Medical advice and consultation is not easily obtained and situations arise that call for great resourcefulness on their part. The very nature of their work calls for independent thought and action. For this reason considerable time and effort during their senior year is devoted to the recognition and treatment of the common diseases prevalent in Samoa, preventive medicine and control of communicable diseases, the keeping of statistical data and the writing of histories of cases that will enable the public-health officer to arrive at a diagnosis in event no medical officer has seen the patient.

In addition to the actual treatment of the sick, these nurses are active in spreading knowledge of preventive medicine and in bringing to the attention of the Medical Department certain cases which are investigated and either transferred to the Samoan Hospital or else followed in their homes.

There were 26 student nurses in the training school June 30, 1930, 5 of whom were graduated in November with appropriate exercises conducted in the station pavilion; 2 are in their fourth year; 14 were enrolled during the year; 4 resigned to be married; 2 were discharged for the good of the service; 1 resigned because she did not care for nursing; 1 was discharged for inaptitude; and 1 died of pulmonary tuberculosis. This leaves 26 in the training school at the present time.

There were 18 graduate nurses in the Public Health Service on June 30, 1930; 5 were graduated in November, 1930; 6 resigned to be married, leaving a total of 17 graduate nurses. Three of these, including the Samoan chief nurse, are on duty at the Samoan Hospital; 3 in the central district; 1 in the eastern district; 1 in Aunu'u; 4 in the western district; 3 in Tau; 1 in Ofu; and 1 in Olsega.

Twenty-three graduate nurses are needed in the Public Health Service to accomplish the work of the department thoroughly and satisfactorily. As shown, at the present time there are 17 graduates; 2 will be graduated in November of this year and 6 are due for graduation in November, 1932. It may be necessary to graduate the 1932 class in the spring of 1932 in order to fill the usual vacancies created by resignations for the purpose of marriage. It was found expedient to graduate one-half of the 1930 class in April of that year, and the necessity may arise for this procedure in the spring of 1932, which can be done without any great detriment to the respective nurses, as they will have completed  $3\frac{1}{2}$  years of the 4-year course.

Resignations for the purpose of marriage have always been common. After leaving the service these nurses are of considerable value

to the people of the villages in which they reside, in view of their special training and their willingness, as a rule, to administer to the sick, do minor surgical dressings and advise the public-health officer of the prevailing conditions. It is a common practice to provide these nurses with drugs, dressings, etc., and to allow them to continue medical work in an unofficial capacity.

#### MARITIME QUARANTINE

The Customs, Immigration, and Harbor regulations of American Samoa provide that the public-health officer or his representative shall board all incoming vessels for the purpose of granting pratique. Inspections and quarantine procedures are conducted in accordance with the Quarantine Laws and Regulations of the Government of the United States.

Seventy-six vessels entered the port of Pago Pago, the port of entry, during the year 1930.

Quarantine was established over western Samoa (British) by reason of an epidemic of bacillary dysentery on March 7, 1931, and was lifted on May 29, 1931, at which time the epidemic had abated to such an extent that with the approach of the cold season there was reasonable assurance that this disease would not be introduced into American Samoa. This quarantine was limited to passengers entering American Samoa, who expected to reside here. Passengers making passage from western Samoa to take the north or south bound steamers were allowed to enter and leave on respective steamers. This quarantine also applied to fresh fruits and foodstuffs. Boats from western Samoa were allowed to enter and discharge freight and mail. The crews of such boats were required to remain aboard and the boats were kept in quarantine while in this port.

#### LABORATORY DIVISION

The present director of the laboratory division is Chief Pharmacist's Mate H. R. Evans, United States Navy. The central laboratory is equipped to do all the usual work required of a well-equipped laboratory.

Very little study of pathological tissue has been done owing to the fact that it is quite difficult to obtain authority for autopsies. Only three autopsies were performed during the year.

The Samoan Hospital and outlying dispensaries are equipped to do ordinary routine laboratory work. The laboratory work listed below does not include that done at the Samoan Hospital, which is reported elsewhere in this report.

The graduate Samoan nurse formerly serving as assistant to the director of this division has been replaced by a young Samoan boy.

This change will give this boy an opportunity to become eventually a qualified laboratory man and also removes the element of frequent change, incident to the employment of nurses in this work.

## LABORATORY EXAMINATIONS

Agglutinations.....	17	Gastric analyses.....	28
Blood chemistry.....	33	Milk.....	2
Blood groupings.....	4	Miscellaneous chemical analyses	15
Blood counts.....	554	Sedimentation time.....	4
Blood cultures.....	42	Serum examinations.....	127
Culture, feces.....	397	Smears.....	405
Culture, throat.....	58	Spinal fluids.....	16
Culture, urine.....	69	Sputums.....	258
Culture, miscellaneous.....	14	Urinalyses.....	420
Dark field.....	5	Water analyses.....	927
Feces.....	243		
Filarial smears.....	191	Total.....	3,829

## DIVISION OF SANITATION

Hospital Corps men of the United States Navy are detailed as sanitary inspectors in the eastern and western districts of Tutuila and in the districts of Ofu and Tau in the Manua Group. These sanitary inspectors come under the direct supervision of the respective district health officers. Villages are regularly inspected and a complete report of sanitary conditions in each village is submitted monthly to the public health officer, via the district health officers. The Samoan is a law-abiding individual, but it is constantly necessary to remind him of sanitary regulations. Inspections are made at regular intervals, and a great deal can be accomplished by men of forceful character when the people are approached in the proper way. It is very difficult to enforce strange and unaccustomed sanitary regulations. The results of coercion are never as good as those obtained through cooperation on the part of the people. In the central district of Tutuila we have two very intelligent Samoan boys employed as sanitary inspectors. One of these boys has been with the Public Health Service for a period of two years and a half, the other for about 18 months. These boys have been instructed in the rudiments of hygiene and sanitation, especially in the control of mosquito and fly breeding, the disposal of human excreta, the protection of water supplies, the detection of and the reporting of communicable diseases, and an elemental study of epidemiological matters. These two Samoan boys come under the direct supervision of the central district health officer.

During the fiscal year 1930-31, 86 sanitary abatement notices were served against offenders of sanitary regulations in the central district. It was necessary to take only three of these people before

the secretary of native affairs for disciplinary action. Fifty were taken before the district magistrate in Ofu district; 48 in the Tau district; and 5 in the eastern public health district. All district health officers have shown a commendable spirit in carrying out sanitary measures. This was especially true in Tau and Ofu. The latter district was found at one time during the year to be in a very bad sanitary condition, especially in regard to fecal deposits on the beach. Steps were taken to improve this condition, and the last inspection made showed a marked improvement.

*Disposal of human excreta.*—The greater number of the native villages in American Samoa are located along the coast line. In the past a great many beach latrines were constructed along the water front. All of these latrines have been destroyed by hurricanes or high seas at one time or another except those in protected areas, such as the beach around Pago Pago Bay. During the hurricane of January, 1931, all three of the beach latrines in the village of Nu'uuli were demolished, and they have not since been reconstructed. Several "fonos" were held with the people of the village of Nu'uuli by the public health officer and the public works officer and a proposition was made to the people to reconstruct these latrines with village labor under the supervision of the public works officer at a very low cost. The people promised on several occasions to make a deposit in order that this work could be undertaken, but they failed to raise the required amount and the work has not been done. Where possible and where there is some assurance that these latrines will weather storm conditions, this method of excreta disposal is certainly the most desirable. The Samoan is quite regular as regards his personal habits, usually going to the beach in the early morning to answer calls of nature. The paddle system has been tried. Success of this system is variable and depends in a great measure upon the force and diligence of the district health officers and sanitary inspectors and the cooperation of the natives.

*Pit latrines.*—These latrines, as seen in American Samoa, are insanitary and require constant care to keep them in a sanitary condition. This is usually not done. There is one community flushing latrine in the village of Fagatogo, adjacent to the United States naval station. The community flushing latrine in the village of Vaitogi was damaged to such an extent during the hurricane of January, 1931, that it had to be abandoned and has recently been demolished by the village people.

The pollution of the soil around plantations is a serious matter and very difficult to control. Most of the plantations are located on the hillsides and watersheds, and as a result the majority of the streams are polluted. In Pago Pago Bay area, where the reed ex-

tends far out, the disposal of human excreta is not without its hazards to public health, as the natives bathe in the polluted water and eat uncooked fish.

*Mosquito and fly control.*—The control of these insects as carried out in American Samoa consists of frequent inspections of houses and premises, keeping the ground free of all collections of rubbish, garbage, refuse, tin cans, coconut shells, and other materials which create conditions favorable to the breeding of flies and mosquitoes. Filariasis and dengue fever are the two mosquito-borne diseases of interest in American Samoa. Both of these diseases are endemic here. *Aedes variegatus* is the vector of filariasis and is our most common mosquito. *Aedes aegypti*, the vector of dengue fever, abounds here. *Aedes albopictus* abounds here and has also been incriminated as a vector of dengue fever.

During a recent mosquito survey a collection of mosquitoes was sent to the United States Naval Medical School, Washington, D. C., for classification. Through the courtesy of the medical school these specimens were sent to the Bureau of Entomology, where the following identifications were made by Mr. C. T. Green: *Anopheles kochi* (Don); *Aedes aegypti*; *Aedes variegatus*; *Aedes albopictus*; *Culex fasciatus* (Say).

This is the first time that an Anopheline mosquito has been reported in American Samoa. We have made a thorough search for anopheline larvæ and have never been able to obtain any larvæ of the Anopheline species. The question arises whether the determination of this mosquito from the adult specimens submitted was not confused with the *Aedes kochi*, or else there might have been a typographical error in submitting the report.

The extensive swamp directly behind the village of Luma, Tau, is being drained by village labor under the supervision of the public works officer. This swamp was a decided mosquito menace.

*Water supplies.*—A water commission, composed of the captain of the yard of the United States naval station, the secretary of native affairs, the public health officer, and the public works officer, commenced to function in February, 1930. This commission acts upon all matters pertaining to the selection of sights for reservoirs, desirability of water, and the financing of the building of water systems for the various villages.

During the year 1930 a water system was built for the village of Sailele in the eastern district, which now gives this village a greatly needed sanitary water supply. Twenty-four villages in American Samoa are now equipped with sanitary water systems. Considerable repair work has been done from time to time during the year on these water systems.

During the recent hurricane the reservoir at Alao was damaged to such an extent that it had to be rebuilt. This was done out of hurricane funds at no cost to the village. A small additional reservoir of 800-gallon capacity was built by the village of Fagasa during the year. The village of Futiga is still in need of a water supply. Several surveys were made during the year, but no practical solution has been reached. The adjacent village of Mapusaga has a large reservoir which at the present time supplies the villages of Mapusaga, Faleniu, Iliili, and Vaitogi and has a capacity sufficient to take care of the village of Futiga. In order to cut in Futiga on this supply, it will be necessary to enlarge the delivery main leading from the reservoir to the other villages and the laying of pipe to Futiga. The cost of putting in a larger delivery main would necessarily have to be proportionately borne by all of the villages concerned. The people of the villages of Mapusaga, Faleniu, Iliili, and Vaitogi are not willing to advance any funds to carry out this project. There are no available sources at Futiga for an independent water supply. The present public works officer is going to make a survey with the view in mind of determining whether the building of a catchment area is practicable.

#### DENTAL DIVISION

Lieut. H. J. LaSalle (Dental Corps), United States Navy, attached to the United States naval station, is the only dentist in American Samoa. The dental officer renders service to the Navy personnel, patients in the Samoan Hospital, and to all others who apply direct to the dental clinic. An average of 50 patients are treated by the dental officer each month.

The dental officer has observed that the half-castes have much better teeth than the full-blooded Samoans and that the use of the toothbrush and other methods of oral hygiene are much more common among the half-castes. The native Samoan gives little or no attention to his teeth and presents himself for treatment only when suffering pain or when the condition is advanced to such an extent that little can be done in the way of repair or nothing other than extraction. Most natives up to the age of 30 years have little trouble with their teeth. The teeth are large and well proportioned. As they advance beyond the age of 30 years, gingivitis is very common, with destruction and absorption of the alveolar processes. There has been no evidence of Vincent's disease among the natives during this period.

The proper care of the teeth is being taught in the public schools and some headway has been made in inculcating the principles of oral hygiene in the younger element.



Examination of the oral conditions of the members of the fita fita guard and band showed that the teeth of this group are in an excellent state of preservation. This fact is attributed in part to the practice of oral hygiene and availability of dental treatment. There is no provision for prosthetic work.

#### OUTLYING DISPENSARIES

There are four outlying dispensaries located as follows: 1 on the island of Ofu and 1 on the island of Tau in the Manua Group, 1 at Amouli in the eastern district and 1 at Leone in the western district on the island of Tutuila. The central district health activities are controlled from central headquarters located in part at the naval dispensary and in part at the Samoan Hospital.

The personnel of each outlying dispensary consists of a chief pharmacist's mate, United States Navy, in charge, in the capacity of district health officer; a pharmacist's mate, United States Navy, who is the sanitary inspector for the district and an assistant to the chief pharmacist's mate; one medical fita fita who is used as an interpreter and dispensary assistant; and two to four graduate Samoan nurses for making regular visits to the native villages.

The chief pharmacist's mates who are ordered to Samoa for duty at outlying stations are usually men of experience and undoubted qualifications, as the responsibilities are quite heavy for a man of this rating. The locations are isolated, and it is difficult and at times impossible to obtain assistance. The chief in charge has to rely solely on his own judgment in handling a great many emergencies. This is particularly true of Ofu and Tau and to a lesser extent in the case of Amouli and Leone. The ambulance makes a regular weekly trip to Leone and at any other time when occasion arises.

*Improvements at outlying stations.*—During the year the four outlying dispensaries were equipped with "icy ball" refrigerating units. These units, in addition to furnishing the luxury of a limited amount of ice to the Hospital Corps men detailed to these isolated dispensaries, allows a small supply of necessary serums and vaccines to be kept at them. Electric-lighting systems have also been supplied at each of the four outlying dispensaries. They are operated from the radio storage batteries, motors having been installed for charging them. These ordinary necessities of modern living have not only increased the efficiency of the medical work carried on at these dispensaries but have greatly improved the morale of the personnel stationed at them. In Amouli the privilege of having lights has been extended to the whole village.

After the hurricane of January 15 and 16, 1931, it was necessary to rebuild entirely the dispensary building and quarters for the

district health officer at Ofu and to replace all equipment and medical supplies, as practically nothing of value, with the exception of the microscope, was salvaged. Additional rooms were added to these quarters to accommodate the sanitary inspector and radioman. It was also necessary to make extensive repairs to the quarters at Tau, due to hurricane damage. All buildings at the four outlying stations have been renovated and repainted during the year.

#### THE HURRICANE OF JANUARY, 1931

The hurricane that occurred in American Samoa on January 15 and 16, 1931, causing considerable damage to property and crops, was covered in a special report. The damage to property and plantations and the resultant food shortage was quite extensive and serious, especially so in Ofu and Tau, and to a lesser extent on the Island of Tutuila.

There were no casualties, which was quite remarkable in view of the severity of the storm. A fair number of minor injuries were reported. No sickness or disease of any importance followed in the wake of the storm, unless the occurrence of bacillary dysentery in March can, in some indirect way, be attributed to the effects of the storm by reason of the marked change in the diet of the people. The banana, breadfruit, and papaya crops were totally destroyed in Ofu and Tau and practically so, but, to a lesser extent, on the island of Tutuila. The taro crop was damaged, especially so by infestation of worms which usually follows a hurricane. The increased consumption of coconuts, the substitution of salmon, rice, flour, and biscuits for their usual articles of diet predisposed to infections of the intestinal tract, such as bacillary dysentery.

The shortage of food did increase the number of deaths in the higher age groups, especially very old people, and it was quite hard on the infants and younger children. However, there was no increase in infant mortality rate during the four months following the storm.

The people of American Samoa accepted their losses in a most cheerful and commendable spirit and promptly went about the reconstruction of their villages and replanting of their plantations.

The public health department personnel are to be commended for the way in which they conducted themselves during and immediately after the storm and for the very active part they took in food relief work that was initiated by the Governor of American Samoa and carried on with funds appropriated by the United States Navy Department and funds contributed by the American Red Cross. The food relief work was timely and sorely needed by the people of American Samoa, especially so in Ofu and Tau and certain villages on the Island of Tutuila. The issue of powdered milk in the form.

of Klim for the use of infants and younger children was of great help to this group.

#### SAMOAN HOSPITAL

The Samoan Hospital was founded in 1911. It consists of one main 2-story building having seven rooms. On the first floor is located the dressing room, clinic room, dispensary and medical office. There are three private rooms for patients on the second floor. There are three small detached buildings in close proximity to the main building, namely, the operating room, sterilizer room, and toilet and bath rooms. There are 4 "fales" (native houses), 1 bungalow-type ward and 2 small hutments used for ward patients, and 3 separate frame buildings used for quarters for the Navy and Samoan nurses.

The medical officer in charge of the hospital is responsible for the surgical and medical treatment of the patients in the hospital and those attending the hospital clinic and for the administration of the hospital under the supervision of the public-health officer, who devotes a considerable part of his time to consultations on patients and in respect to general administrative policies.

This is the only institution of its kind in American Samoa where seriously ill patients are admitted and surgical practice is carried on. In addition to the medical and surgical work, a very important feature of this institution is the instruction and training of native Samoan nurses for future work in the field among their own people as members of the health department.

The hurricane also did considerable damage to the hospital. Hutments or cottages Nos. 1 and 2 were rendered untenable and "fales" Nos. 2 and 3 were wrecked, necessitating the transfer of a great many patients to their homes. The hutments were out of commission until February 8, 1931; "fale" No. 2 until March 25, 1931, and "fale" No. 3 until April 25, 1931.

Considerable new construction and many repairs were completed during the past five months at the hospital. Reconstruction work on "fale" No. 2 consisted of the following: Thatched roof replaced by corrugated iron, outside supporting posts and other supporting timbers renewed, cement floor resurfaced, entire "fale" inclosed with copper wire screen for mosquito protection and repainted, inside and out, detached kitchen built, and modern electric-light fixtures installed. "Fale" No. 3 was razed, the oval cement floor squared and resurfaced, and a bungalow-type frame building, American style with corrugated iron roof, erected. A ventilator was put in the ceiling and the entire building screened for mosquito protection. "Fale" No. 5 was reconstructed in the following manner. Thatched roof replaced with corrugated iron, cement floor squared

and resurfaced, detached kitchen erected, and building screened with copper wire. The squaring of floor with corresponding change in roof and the removal of the kitchen to the outside has very materially increased the bed capacity of this "fale." The rebuilding of "fale" No. 1 will be started in July, 1931.

Clotheslines with T-type wooden end supports have been erected in concealed positions for each house. They are sufficient for the needs of the "sigas" and the patients. Woven split bamboo weather awnings are being put up on the weather sides of the two cottages. This material is quite durable and will no doubt stand up well under severe storm conditions. This was not true of canvas curtains, which were carried away during the hurricane in January. These awnings are being tried out, for eventually some awning of this type may have to be provided for the other "fales" or wards of the hospital which are now protected by canvas curtains.

The capacity of the hospital prior to new construction was:

Cottages 1 and 2.....	8
Private rooms.....	4
Fale 1.....	10
Fale 2.....	10
Fale 3.....	5
Fale 4.....	10
Fale 5.....	6
Total.....	53

Changes of designation since new construction:

- Fale 1 becomes house 1.
- Fale 4 becomes house 2.
- Fale 5 becomes house 3.
- Fale 2 becomes house 4.
- Fale 3 becomes house 5.

Capacity of hospital with new construction now completed, including house 1, which will be rebuilt during the first part of this coming fiscal year:

Cottages 1 and 2.....	8
House 1.....	16
House 2.....	11
House 3.....	11
House 4.....	11
House 5.....	12
Private rooms.....	4
Total.....	73

As set forth above there is bed capacity for 73 patients. This represents the number of patients that can be taken care of comfortably without any crowding but expansion is possible if occasion arises.

The clinic or out-patient department of the Samoan Hospital is an important feature of this institution. It is well attended. Tri-weekly clinics are held and during the year 1930, 1,483 case diagnoses were made. This figure does not include the large number of dressings, treatments for minor ailments, and reexaminations made. During the year 1930, 78 operations were performed.

The dispensary at the Samoan Hospital is in charge of a pharmacist's mate, second class, United States Navy, and is fully equipped for doing the usual work required of a naval dispensary. The establishment of a small branch laboratory has greatly facilitated both the work of the clinic and the hospital. Major laboratory examinations are made at the central public health laboratory, which is located at the United States naval dispensary. There were 1,727 laboratory examinations made during the year 1930 at this branch laboratory.

A modern fracture bed was purchased during the year for the hospital. A portable obstetrical table was obtained through funds contributed by the Tutuila Rugby Union.

Mr. George H. C. Reid presented a very handsome wall clock to the hospital during the year and in addition the sum of \$25.35, which is to be used to purchase a refrigerator for house No. 5.

#### CLINICAL WORK OF THE SAMOAN HOSPITAL IN 1930

Five hundred and one patients were treated in the Samoan Hospital with an average of 14.79 hospital days per patient, and a daily average of 20.30 house patients as compared with 15.81 in 1929, 14.33 in 1928, and 11.34 in 1927. Admissions to hospital equaled 50.1 per 1,000 of the population of American Samoa.

There were 22 deaths in the hospital during the year 1930 as compared with 30 for the year 1929. The primary causes of deaths that occurred in the Samoan Hospital during 1930 were given as follows:

Anemia, aplastic.....	1
Hemorrhagic disease of the newborn.....	1
Influenza and associated bronch-pneumonia.....	4
Myocarditis, chronic.....	1
Meningitis, acute.....	1
Meningitis, influenzal.....	1
Peritonitis, acute.....	1
Pneumonia, broncho.....	2
Pneumonia, lobar.....	4
Pneumonia, tuberculous.....	1
Premature infant.....	1
Premature infant, exposure.....	1
Premature infant, imperforate anus.....	1
Tetanus.....	1
Thrombosis, cavernous sinus, infective.....	1
Total .....	22

## CLINIC CASES

Exclusive of readmissions, dressings, and treatments for minor ailments.

Abortion.....	3	Endocarditis, acute.....	6
Abortion, incomplete.....	1	Encephalitis, acute.....	2
Abortion, threatened.....	1	Engorgement, breast.....	1
Abrasion.....	5	Enteritis.....	14
Abscess.....	58	Epistaxis.....	1
Adenitis, axilla.....	3	Feeding cases.....	11
Adenitis, cervical.....	3	Filariasis.....	19
Adenitis, inguinal.....	3	Fissure, lip.....	1
Amputation stump.....	1	Fissure, nipples.....	2
Amenorrhea.....	1	Foreign body, foot.....	1
Amebiasis.....	1	Foreign body, hand.....	1
Anemia, secondary.....	1	Fracture, fibula.....	1
Anus, imperforate.....	1	Fracture, skull.....	1
Appendicitis, acute.....	5	Fracture, process lumbar spine.....	2
Appendicitis, chronic.....	1	Furunculosis.....	2
Arthritis, acute.....	5	Gangrene, scrotum.....	2
Arthritis, chronic.....	3	Gastralgia.....	1
Ascariasis.....	113	Gastritis, acute.....	4
Asthma.....	4	Gastritis, chronic.....	8
Blindness, right eye.....	1	Gastroenteritis.....	8
Bronchitis, acute.....	99	Gonococcus infection, examined for.....	1
Bronchitis, chronic.....	16	Gonococcus infection, cervix.....	1
Burns.....	2	Gonococcus infection, epididymis.....	2
Bursitis.....	1	Gonococcus infection, urethra.....	1
Cataract.....	1	Gonococcus infection, vagina.....	2
Catarrhal fever, acute.....	90	Headache.....	6
Cellulitis.....	10	Heart disease, valvular.....	1
Cerumen impacted.....	2	Hemorrhage, cerebral.....	1
Chest examinations.....	24	Hemorrhage, intestinal.....	1
Chillitis.....	1	Hemorrhage, postpartum.....	1
Cholecystitis.....	2	Hemorrhage, pulmonary.....	1
Circumcision, infected.....	1	Hemorrhoids.....	1
Colitis, acute, nonspecific.....	1	Hernia, inguinal.....	2
Conjunctivitis, acute.....	23	Hookworm disease.....	1
Conjunctivitis, chronic.....	1	Hordeolum.....	1
Constipation.....	23	Hydrocele.....	2
Contusions.....	28	Hypertrophy, prostate.....	1
Cyst.....	1	Impetigo contagiosa.....	1
Cystitis, acute.....	1	Infancy, no disease.....	23
Dengue fever.....	55	Infancy, premature.....	1
Dental caries.....	1	Infection, umbilical cord.....	1
Deviated nasal septum.....	1	Influenza.....	49
Diphtheria, carriers.....	4	Laceration, perineum.....	1
Dysmenorrhea.....	4	Malnutrition.....	6
Eczema.....	2	Malposition, uterus.....	2
Elephantiasis, leg.....	1	Mastitis, acute.....	1
Elephantiasis, scrotum.....	1	Mastitis, chronic.....	1
Embolus, cerebral.....	1		
Emphysema.....	1		

Mastoiditis, acute.....	1	Rhinitis, acute.....	2
Meningitis, acute.....	1	Rhinitis, hypertrophic.....	1
Meningitis, influenzal.....	1	Ringworm.....	21
Menopause.....	2	Salvarsan reaction.....	1
Menorrhagia.....	1	Scabies.....	1
Migraine.....	1	Sinus, foot.....	1
Mumps.....	2	Sinusitis.....	3
Myositis, acute.....	33	Skin disease.....	3
Myositis, chronic.....	10	Sprains.....	13
Nephritis, acute.....	2	Strain, eye.....	1
Nephritis, chronic.....	1	Subinvolution, uterus.....	1
Neuritis, sciatic nerve.....	2	Submersion, nonfatal.....	2
No disease.....	20	Tattoo infection.....	1
Otitis, media, acute.....	4	Tinea imbricata.....	1
Otitis, media, chronic.....	2	Tetanus.....	1
Otitis, externa.....	14	Tonsillitis, acute.....	8
Paresthesia.....	1	Tuberculosis, chronic, pulmo- nary.....	10
Parotitis, acute suppurative.....	8	Tuberculosis, hip joint.....	1
Parturition.....	15	Tuberculosis, pulmonary, obser- vation.....	4
Pelvic examinations.....	8	Tuberculosis, pulmonary, sus- pect.....	12
Peritonitis, acute.....	4	Tuberculosis, spine.....	2
Periostitis.....	1	Tumor, unclassified, hand.....	1
Pharyngitis, acute.....	8	Tumor, fibroid, unclassified.....	1
Phimosis.....	1	Typhoid fever.....	2
Photophobia.....	1	Ulcer, corneal.....	3
Placenta, retained.....	1	Ulcer, foot.....	1
Pleurisy, acute.....	7	Ulcer, leg.....	1
Pneumonia, broncho.....	44	Vitiligo.....	1
Pneumonia, lobar.....	13	Worm suspect.....	31
Pneumonia, unresolved.....	2	Wound, incised.....	11
Poisoning, fish.....	3	Wound, lacerated.....	54
Poisoning, kerosene.....	1	Wound, punctured.....	30
Pregnancy, normal.....	9	Yaws.....	170
Premature labor.....	1		
Pterygium.....	1		
Puerperal sepsis.....	1		
Pyelitis.....	1		
Redundant prepuce.....	44	Total.....	1,483
Rheumatic fever.....	2		

## IN-HOSPITAL DEPARTMENT

The following cases were treated in the wards and private rooms of the Samoan Hospital during the year 1930:

Abortion.....	2	Amebiasis.....	1
Abscess, filarial.....	16	Anus, imperforate.....	1
Abrasion.....	1	Aplastic anemia.....	1
Abscess, unclassified.....	6	Appendicitis, acute.....	4
Adenitis, cervical.....	1	Arthritis, acute.....	1
Adenitis, tubercular.....	1	Arthritis, chronic.....	3
Adenitis, inguinal.....	6	Ascariasis.....	8

Asthma.....	1	Migraine.....	1
Bronchitis, acute.....	26	Mumps.....	2
Bronchitis, chronic.....	2	Myocarditis.....	2
Burns, unclassified.....	2	Myositis, acute.....	1
Cardiac decompensation, acute.....	1	Nephritis, acute.....	1
Catarrhal fever, acute.....	24	Neuralgia.....	1
Cellulitis.....	7	No disease.....	4
Cholecystitis, chronic.....	2	Otitis, media, acute.....	1
Colitis, spastic.....	1	Otitis, externa.....	2
Conjunctivitis, acute.....	2	Ovarian cyst.....	1
Constipation.....	9	Parotitis, suppurative, acute.....	1
Contusion.....	3	Parturition.....	17
Dengue fever.....	44	Peritonitis, acute.....	3
Diphtheria carrier.....	3	Pharyngitis, acute.....	2
Dysmenorrhea.....	3	Pleurisy, acute.....	2
Elephantiasis, scrotum.....	3	Pneumonia, broncho.....	44
Embolus, cerebral.....	3	Pneumonia, lobar.....	15
Encephalitis, acute.....	1	Pneumonia, tubercular.....	2
Endocarditis, chronic.....	1	Poisoning, fish.....	1
Enteritis.....	2	Pregnancy, normal.....	4
Epididymitis, filarial.....	1	Puerperal sepsis.....	1
Epistaxis.....	1	Pyelitis.....	2
Filariasis.....	18	Retained placenta.....	1
Fracture, fibula.....	1	Rhinitis, acute.....	1
Fracture, spine.....	1	Rhinitis, atrophic.....	1
Gangrene, scrotum.....	1	Salpingitis, acute.....	1
Gastritis, acute.....	1	Sinus, foot.....	1
Gastroenteritis.....	6	Sprain.....	1
Gonococcus infection, cervix.....	4	Submersion, nonfatal.....	1
Gonococcus infection, epididymis.....	2	Tattoo, infected.....	1
Gonococcus infection, eye.....	1	Tetanus.....	1
Gonococcus infection, joint.....	1	Thrombosis, cavernous, sinus, in- fective.....	1
Gonococcus infection, urethra.....	2	Tinea imbricata.....	1
Hemorrhagic disease, newborn.....	1	Tonsillitis, acute.....	3
Hemorrhoids.....	1	Tuberculosis, chronic, pulmonary.....	12
Hookworm disease.....	2	Tuberculosis, pulmonary (obser- vation).....	2
Infancy, no disease.....	18	Tuberculosis, pulmonary (sus- pect).....	4
Infected circumcision.....	1	Tuberculosis, millary.....	1
Infancy, premature.....	2	Tuberculosis, spine.....	1
Infection, umbilical cord.....	1	Typhoid fever.....	4
Influenza.....	44	Ulcer, leg.....	1
Laceration, ligament, ankle.....	1	Vaccinia.....	3
Laceration, vulvula.....	1	Varicella.....	1
Laceration, perineum.....	2	Vincent's angina.....	3
Leukorrhea.....	1	Wound, lacerated.....	22
Lymphangitis, breast.....	1	Wound, incised.....	4
Malnutrition.....	4	Wound, punctured.....	2
Malposition, uterus.....	1		
Meningitis, acute.....	1		
Meningitis, tubercular.....	1		



## SURGICAL OPERATIONS

Abdominal section, opening and draining of ovarian cyst.....	1
Abdominal section, retroperitoneal sarcoma.....	1
Abortion, incomplete, curettage and extraction of dead fetus.....	1
Appendectomy.....	1
Circumcisions.....	46
Decompression.....	1
Decompression and evacuation of brain abscess.....	1
Dilatation and curettage of uterus.....	1
Elephantiasis, scrotum, excision of elephantoid tissue.....	2
Excision of cyst, foot.....	1
Excision of lymph glands, cervical.....	2
Excision of sinus, foot.....	1
Exploratory laparotomy, drainage of retroperitoneal abscess.....	1
Gangrene of scrotum, excision of gangrenous portion of.....	1
Gangrene and cellulitis of foot, multiple incisions and drainage.....	1
Hemorrhoidectomy.....	1
Herniotomy, Bassini modified.....	3
Hydrocele, bottle operation.....	3
Hydrocele, bilateral.....	1
Hydrocele, infected, incised, and drained.....	1
Incision and drainage of abscess unclassified.....	11
Incision and drainage of abscess, filarial.....	7
Incision and removal of foreign body (needle), foot.....	1
Lipoma, removal of.....	1
Peritonitis, tubercular, drainage.....	1
Removing of ingrowing nail.....	1
Repair of laceration.....	13
Retained placenta, removal of.....	1
Sebaceous cyst, removal of.....	1
Total.....	108

## ANESTHESIAS

Chloroform.....	5
Ether.....	9
Procaine.....	94
Total.....	108

## HOSPITAL LABORATORY

The following examinations were made at the hospital laboratory during the fiscal year ended June 30, 1931:

Blood counts.....	447
Urinalyses.....	301
Sputum examinations.....	317
Filarial smears.....	187
Smears, miscellaneous.....	87
Stool examinations.....	388
Total.....	1,727

## SWAINS ISLAND

Swains Island, which is under the administrative supervision of the Governor of American Samoa, is visited once a year by the governor and other officials for various purposes incident to an inspection, and at that time an annual physical examination of the natives is conducted by the medical officer of the staff. The following notes made on the occasion of the official visit on May 13, 1931, are of interest from the point of view of vital statistics and sanitation:

## CENSUS

Ages	Males	Females	Total for group
Less than 12 months.....	4	3	17
1 to 5 years.....	7	9	16
5 to 10 years.....	7	7	14
10 to 20 years.....	6	6	12
20 to 30 years.....	9	9	18
30 to 40 years.....	6	7	8
40 to 50 years.....	1	3	4
50 to 60 years.....	5	2	7
Total.....	45	46	91

Deaths, 1 (cause unknown); births, 7.

## CASES SEEN AT THE CLINIC

Arthritis.....	2
Deafness.....	1
Defective vision.....	2
Dysmenorrhea.....	2
Chest condition undetermined.....	1
Fracture, pelvis.....	1
Gastritis.....	2
Pterygium (both eyes).....	1
Ringworm.....	5
Unhealed cord.....	1
Yaws.....	2

## TREATMENTS

Neoarsphenamine injections.....	2
Other treatments.....	17

## VACCINATIONS

Vaccinations (nonimmunes).....	18
Revaccinations.....	4

The natives in general are in excellent health and the island is very clean and in good sanitary condition. Rain water is used and the supply is sufficient. Several good-sized reservoirs are located on the island. Mosquitoes are limited to a seasonal prevalence, but flies are abundant at all times. A mild epidemic of dengue fever is said to have occurred in January, 1931.

**THE CONTROL OF LEAD ABSORPTION IN THE PREVENTION OF LEAD POISONING**

"Instructions for painting and cementing vessels of the United States Navy, July, 1931," by the Bureau of Construction and Repair outlines the precautions to be instituted during painting or preparing surfaces for repainting and necessary prophylactic methods in order to reduce to a minimum the invalidism of those who of necessity come in contact with lead.

Paragraph 9, page 49, of the above-mentioned instructions directs that those assigned to painting or preparing surfaces for repainting be examined at weekly intervals to determine the occurrence of lead absorption and the propriety of continuing these men on the work or their need to be relieved, whether temporarily or permanently.

The responsibility of medical officers involved in the above paragraph is not new, but is modified in the direction of specificity and is definitely imposed in the interest of more certain prevention of lead poisoning. The early ascertainment of lead absorption as distinct from poisoning is the crux of the matter, and for the purpose of giving the service the latest information on the means of determining such absorption, as a guide to recommendations looking to the removal of an individual from exposure to the metal, the subject was restudied and is herein reviewed. The requirements of the above instructions as they concern medical officers seemed to give occasion for a pointed discussion of lead detection, and in preparing these notes the aim has been to present the method or methods which are at once the most reliable and within the competence of all service units of activity.

As a means to intelligent action in individual cases a base line must be established for each, and this requires that the physical condition be known and made a matter of record preliminary to employment in lead-exposing work. Such record should cover both laboratory and physical examination and the filed written notation thereafter employed for comparison with the findings from week to week in the prescribed examination conducted during the individual's exposure to lead. With this as a background one may note the development of lead absorption by laboratory findings—stippling, anemia, etc.—or at least the early clinical signs of lead poisoning, before any marked degree of damage is done. It should be kept in mind that the degree of stippling as determined by the number of stippled cells found per 1,500 cells and also per field have a definite ratio to the degree of lead absorption and also lead poisoning.

Valuable information on the subject of lead poisoning is to be found in various available publications<sup>1</sup> as well as the literature in

<sup>1</sup> Practical bacteriology, blood work, parasitology, eighth edition (Stitt) ; Lead Poisoning, Vol. VII (Aub, Fairhall, Minot, Resnikoff) ; Lead poisoning from chipping on the U. S. S. *Arizona*, United States Naval Medical Bulletin, April, 1931, by I. L. Norman, Lieutenant, Junior grade, Medical Corps, United States Navy.

general dealing with the industrial hazards of lead workers. This outline merely provides a minimum examination necessary to determine absorption and therefore to prevent disability from poisoning by lead. Those familiar with other sources of information in the matter of lead absorption and poisoning should consult them in their study of cases, but the methods they may suggest should be in addition to and not in substitution for the methods here given.

#### EVIDENCE OF LEAD ABSORPTION

*Stippling.*—With a known history of contact with lead the finding of basophilic granular red blood cells (stippling) is indicative. Stippling is characterized by the presence within the red blood cell of irregular-sized basophilic granules, which vary from small points to fairly large size. Care should be taken in staining with Wright's stain that the diluting water is not too acid. Test distilled water with hematoxylin. (See Stitt's Bacteriology, p. 321.) One may usually find stippling in every case of lead absorption. It is necessary to observe at least 1,500 red blood cells before presuming the absence of stippling. The average field of a thin blood smear examined under oil immersion with 1.9 objective and 1-inch ocular ( $10\times$ ) will contain approximately 150 red blood cells.

Using Wright's stain as suggested above, the finding of 1 definitely stippled cell to 10 fields (1,500 cells) examined should be considered presumptive evidence of lead absorption. While this does not necessarily warrant the release of the individual from painting in open spaces, it does indicate the desirability of his removal from contact with lead dust or paint in inclosed spaces. On the other hand the finding of one stippled cell in each field, "10 to 1,500" cells, calls for removal from contact with all lead, and careful observation.

The determination of the number of red blood cells per microscopic field as outlined above was made by actually counting 1,000 fields in routine thin blood smears. The number of definite stippled cells in 50 normal individuals, 2 slides to the individuals, counting 33 fields to the slide, were found to be less than 1 per slide. The research work to establish this fact was done by Lieut. Commander Otis Wildman, Medical Corps, United States Navy, United States Naval Medical School. Stippling, once present, may remain for months. When to allow a man to return to painting is a matter for the individual medical officer to decide. Other than in lead poisoning stippling occurs in only a few diseases, notably pernicious anemia, leukemia, and malaria. It is also sometimes associated with definite toxic conditions.

*Lead line.*—The Bartonian or lead line of the gums occurs in the gingiva near the border of the teeth. It is more distinct near decaying teeth; and though usually in the gums, may be seen in

the mucosa of the lip or cheek opposite decayed teeth. To differentiate pigmentation on the teeth, one should insert a piece of white paper between the teeth and the gums. This lead line can not be rubbed off. Its presence is definite presumptive evidence of lead absorption to a fairly marked degree. Although this sign is one of the most common findings in lead absorption, it may be late in appearing and the line may be very faint. Careful cleansing of the mouth and the use of a hand lens with white paper as above suggested may be necessary to demonstrate the line in the stage of lead absorption. In other words, while it is part of the picture of poisoning its clinical significance is not necessarily that. In its early development it may be an important factor in detecting absorption.

*Anemia.*—Included in the routine examination of the blood should be a red-cell count and hemoglobin estimation, as mild anemia of secondary type is often associated with lead absorption as an early sign. The appearance of those having this is a peculiar ashen gray and not that typical of the anemia produced by other conditions. Red-cell counts near 4,000,000 indicate the need of close observation for a further drop. The variation in number of red cells is not great, and it is rare to find less than 3,000,000.

#### EVIDENCE OF LEAD POISONING

Individuals should not be allowed to remain in contact with lead long enough to become clinical cases with disabling symptoms in contradistinction to laboratory cases with warning signs, and it is the medical officer's duty to prevent the transition from the stage of absorption to the graver condition, but this frequently happens in spite of utmost care, and it may be useful therefore to give a brief résumé of the clinical evidence of such a development.

The symptoms include weakness, lassitude, lack of appetite, loss of weight, nausea, constipation, jaundice, colic, metallic taste in mouth, lead line, fine tremor of the muscles of hand, tongue, face, or eyelids, diminished power to extend the flexed wrist, and various other lead palsies. There is also anemia with the peculiar intensified ashen-gray color seen in lead absorption. These taken together or in sufficient groups are presumptive evidence of lead poisoning when occurring in those so exposed, and effort should be made to discover them in an early stage. Sight should not be lost of the possibility of cerebral manifestation which at times occurs in this poisoning.

*Anemia.*—This has been sufficiently touched upon above.

*Jaundice.*—While jaundice is rare in lead poisoning, it sometimes occurs in one who is exposed to lead absorption. The finding of jaundice even in slight degree (yellow coloration of sclera) should warrant the removal of the individual from further contact with lead.

*Colic.*—As distinct from the abdominal pain of surgical conditions lead colic is not of itself of serious consequence. It is painful and at times most severe. Lead colic presents a definite diagnostic problem, and the medical officer must be on his guard in attributing colic to lead even in those exposed to lead absorption. Other definite signs must support the diagnosis of lead poisoning and careful examination made to rule out surgical conditions before the colic is attributed to lead.

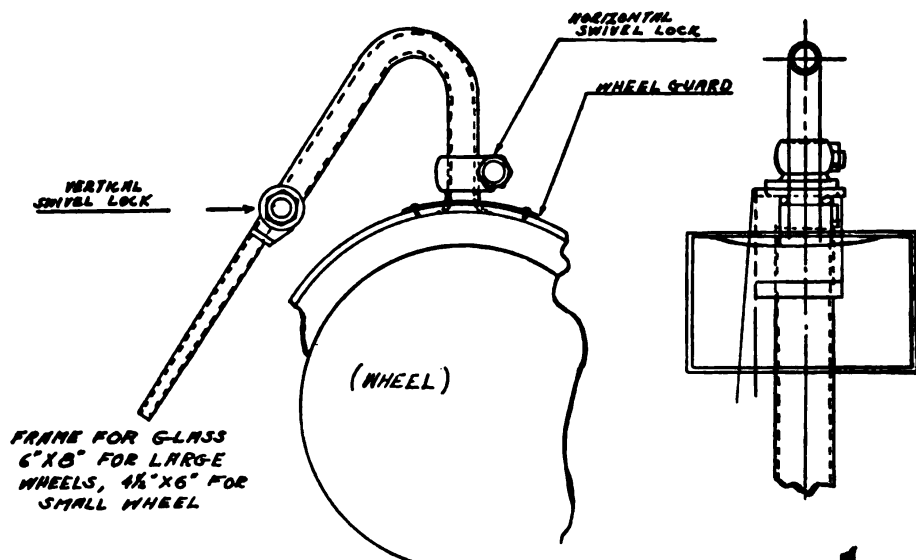
The mechanism of the production of colic by lead is as yet not definitely understood. However, several authors have noted that clinically there is some connection between constipation and lead colic. Usually the colic is preceded by obstinate constipation. Therefore those who are working in contact with lead should not be allowed to become constipated. The term "lead colic" should not be restricted to severe intestinal pain. Smooth muscles of the body may be affected and at times the muscles of the bladder (preventing urination) and other muscles may be attacked.

For further information reference should be made to recent literature.

#### SAFETY DEVICE—EYE GUARD FOR DRY GRINDER STANDS

By A. L. BRYAN, Lieutenant Commander, Medical Corps, United States Navy

A study of the incidence of eye injuries on the U. S. S. *Medusa* led me to recommend the installation of plate-glass shields for dry



#### EYE GUARD FOR DRY GRINDER STANDS

*Made & Installed Aboard - U.S.S. MEDUSA -*

FIGURE 1.—Eye guard (Bryan)

grinders. The accompanying illustration shows the device and the manner of attaching it to the wheel guard. It is estimated that the *Medusa* has about 10,500 man-hour productive periods per week. During that time emery wheels and dry grinders are in use a considerable part of the time. One of the greatest industrial hazards that we had to cope with was foreign bodies in the eyes of the mechanics. Busy mechanics would not stop to put on goggles, although it was a standing order to wear them while using grinders. But since the installation of the protection shields foreign-body eye cases have become almost negligible.

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#### HEALTH OF THE NAVY

The general admission rate, based on statistical returns for diseases, injuries, and poisonings occurring in July, August, and September, 1931, was 530 per 1,000 per annum. The corresponding rate for the first quarter of the year was 592 and for the second quarter, 497. Based on experience in recent years, the expected rate from all causes for the third quarter would be 540 per 1,000 per annum.

The admission rate from disease, 470 per 1,000 per annum, is the same as the expected rate for the corresponding three months of the five preceding years. The admission rate from accidental injuries was 59 per 1,000 per annum. The median rate for the corresponding quarter of the previous five years is 65.

Health conditions ashore in the United States were satisfactory for the quarter. Acute infections of the respiratory type were less prevalent than has been the experience for the past five years. A total of 585 cases of these diseases were reported by all shore stations in the United States during the quarter, of which 193 were notified in July, 184 in August, and 208 in September. Acute catarrhal fever constituted 52 per cent of all admissions in this class. The United States naval training station, San Diego, Calif., reported 102 cases of acute catarrhal fever; United States naval training station, Hampton Roads, Va., 51; United States naval training station, Newport, R. I., 42; and United States naval training station, Great Lakes, Ill., 36. Only three cases of influenza were notified by all shore stations in the United States during the quarter.

The receiving ship, New York, reported one case of scarlet fever in August and one case of typhoid fever in September.

One case of cerebrospinal fever was notified by the submarine base, New London, Conn., in August.

Reports from forces afloat indicate that the morbidity rate for all causes assumed a normal expectancy during July, August, and

September. The admission rate, all causes, was 502 per 1,000 per annum. There were 278 cases of catarrhal fever reported by all ships in July, 274 in August, and 263 in September. Acute catarrhal fever was responsible for 64 per cent of all admissions for diseases of the respiratory system. Small outbreaks of influenza, totaling 2,250 cases, occurred among forces afloat the first and second quarters of the year. During the third quarter only 52 cases were notified by all ships of the Navy. The U. S. S. *Ontario*, station ship at Tutuila, Samoa, reported 15 cases of influenza in September and the U. S. S. *Colorado*, 1 case in July, 5 in August, and 7 in September.

Measles, which was prevalent the second quarter of the year, subsided during the third quarter. Only 40 cases of this disease were notified by forces afloat. The U. S. S. *California* reported 10 cases; U. S. S. *Idaho*, 10; U. S. S. *Wyoming*, 10; and U. S. S. *Texas*, 7.

The U. S. S. *Lexington* reported one case of scarlet fever in August.

A small outbreak of typhoid fever occurred among members of the Second Brigade, United States Marine Corps, stationed at Managua, Nicaragua. From May 31 to August 21, 1931, 12 cases, with 1 death, have been reported from this station. Information regarding the source of infection has not been received.

In a recent report the senior medical officer reports an epidemic of influenza in Samoa, with 3,251 cases, or about 30 per cent of the population. There were 11 deaths among the natives, 9 due to pneumonia and 2 to encephalitis, acute. One white enlisted man on the U. S. S. *Ontario*, station ship, died of pneumonia as a complication.

The disease was introduced by the S. S. *Ventura* en route from Australia. The disease appeared first among the natives of the village of Amouli. The working party of stevedores who removed cargo from the *Ventura* were from Amouli. It is the custom to select the stevedores from the various towns in rotation.

Seven days after the arrival of the *Ventura* a boat race occurred in Tutuila between a crew from Tau in the Manua Group and a crew from Fagaso in the island of Tutuila. The crew which returned to Tau is supposed to have carried the infection to the Manua Group.

The disease showed the usual symptom complex and appears to have been mild except in the presence of complications. Leukocytes varied from 10,000 to 13,000. Thirty-five wives and children of the white Navy personnel were affected. Ninety-five per cent of the Samoan civil employees were ill and 85 per cent of the student nurses at the Samoan Hospital. These percentages would suggest that the percentage of infection among the general population was much higher than the reported cases indicate.



TABLE No. 1.—*Summary of morbidity in the United States Navy and Marine Corps for the quarter ended September 30, 1931*

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	71,997	39,551	19,112	111,676
All causes:				
Number of admissions.....	9,033	5,763	3,065	14,796
Annual rate per 1,000.....	501.85	528.84	641.48	529.96
Disease only:				
Number of admissions.....	7,768	5,361	2,742	13,129
Annual rate per 1,000.....	431.57	542.19	573.88	470.25
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	1,723	1,689	1,001	3,412
Annual rate per 1,000.....	95.73	170.82	209.50	122.21
Venereal diseases:				
Number of admissions.....	3,049	916	645	3,965
Annual rate per 1,000.....	169.40	92.64	70.49	142.11
Injuries:				
Number of admissions.....	1,255	399	321	1,654
Annual rate per 1,000.....	69.73	40.35	67.18	59.24
Poisoning:				
Number of admissions.....	10	3	2	13
Annual rate per 1,000.....	.56	.30	.42	.47

TABLE No. 2.—*Deaths reported, entire Navy, during the quarter ended September 30, 1931*

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		9,057	1,887	81,437	1,192	17,578	525	111,676
CAUSE—DISEASE								
Primary	Secondary or contributory							
Abscess, brain.....	Abscess, lung.....					1		1
Alcoholism, acute.....	Gastritis, acute.....			1				1
Anemia, pernicious.....	None.....			1				1
Angina, Ludwig's.....	Septicemia.....			1				1
Angina, Vincent's.....	Pneumonia, broncho.....					1		1
Appendicitis, acute.....	Peritonitis, general, acute.....	1		1				2
Cellulitis, left forearm.....	Septicemia.....			1				1
Cirrhosis, liver.....	None.....			1				1
Endocarditis, acute ulcer- ative (malignant).....	Pneumonia, broncho.....			1				1
Do.....	Septicemia.....			1				1
Endarteritis, coronary.....	Thrombosis, left coronary artery.....			1				1
Influenza.....	Pneumonia, broncho.....			1				1
Infarction, lung.....	Myocarditis, chronic.....			1				1
Leukemia.....	None.....			2				2
Meningitis, spinal, acute.....	None.....			1				1
Myocarditis, chronic.....	Arterial hypertension.....				1			1
Do.....	Arteriosclerosis, general.....			1				1
Do.....	Enlargement, prostate.....			1				1
Nephritis, chronic.....	Arterial hypertension.....			1				1
Do.....	Poisoning, acute, amio- doxyl benzoate.....			1				1
Obstruction, intestinal, ex- ternal causes.....	Hemorrhage, gastrointes- tinal.....			1				1
Pneumonia, lobar.....	None.....			2				2
Teratoma, testicle.....	Metastasis, lung, liver, and brain.....			1				1
Thrombosis, superior mes- enteric artery (trauma- tism).....	None.....				1			1

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1931.—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
CAUSE—DISEASE—continued								
Primary	Secondary or contributory							
Tuberculosis, chronic pulmonary.	None			1				1
Do.	Myocarditis, acute					1		1
Do.	Pneumonia, lobar			1				1
Do.	Tuberculosis, chronic colon			1				1
Typhoid fever	Hemorrhage, intestinal					1		1
Ulcer, duodenum	Hemorrhage, stomach					1		1
Ulcer, stomach	Dilatation, stomach, acute			1				1
Valvular heart disease, combined lesions, aortic and mitral.	Endocarditis, chronic			1				1
Total for diseases		1		27	2	5		35
CAUSE—INJURIES AND POISONING								
Asphyxiation, spasm glottis.	None			1				1
Burns, multiple	None	1		1				2
Drowning	None	1		8		2		11
Do.	Dementia præcox					1		1
Fracture:								
Compound, skull	None			3	1			4
Simple, skull	None			2		1		3
Do.	Intracranial injury			2				2
Do.	Hemorrhage, intracranial			2				2
Heat exhaustion	None			1				1
Injuries, multiple, extreme	None			12	1	2		15
Landplane crash: Injuries, multiple, extreme	None	1		1		3		5
Intracranial injury	None			2		1		3
Intraspinal injury	None			1		1		2
Rupture, bile duct (traumatism).	Peritonitis, general, acute					1		1
Strangulation, neck	Psychosis, manic	1						1
Wound:								
Gunshot, head	None					2		
Lacerated throat	None			1				
Multiple, machete and gunshot	None					1		
Penetrating, brain	None	1		1				
Poisoning, acute, veronal	None			1				
Total for injuries and poisoning		5		39	3	15		62
Grand total		6		66	5	20		97
Annual death rate per 1,000:								
All causes		2.65		3.24	1.68	4.55		3.45
Disease only		.44		1.33	.67	1.14		1.02
Drowning		.44		.39		.68		.73
Injuries		1.77		1.47	1.01	2.73		1.76
Poisoning				.05				.44

## ADMISSIONS FOR INJURIES AND POISONING, THIRD QUARTER, 1931

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the third quar-

ter, 1931, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, July, Aug- ust, and September, 1931	Admission rate per 100,000 per annum	Admission rate per 100,000 year 1930
<b>INJURIES</b>			
Connected with work or drill.....	702	2,514	2,639
Occurring within command but not associated with work.....	488	1,748	1,914
Incurred on leave or liberty or while absent without leave.....	464	1,662	1,535
All injuries.....	1,654	5,924	6,088
<b>POISONING</b>			
Industrial poisoning.....	3	11	33
Occurring within command but not connected with work.....	4	14	100
Associated with leave, liberty, or absence without leave.....	6	22	26
Poisoning, all forms.....	13	47	159
Total injuries and poisoning.....	1,667	5,971	6,247

*Percentage relationships*

	Occurring within command				Occurring outside command	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or absent without leave	
	July, August, and September, 1931	Year, 1930	July, August, and September, 1931	Year, 1930	July, August, and September, 1931	Year, 1930
Per cent of all injuries.....	42.4	43.4	29.5	31.4	28.1	25.2
Per cent of poisonings.....	23.0	21.0	30.8	62.9	46.2	16.1
Per cent of total admissions, injury, and poisoning titles.....	42.3	42.8	29.5	32.2	28.2	25.0

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

There were no cases during the third quarter of 1931 worthy of notice from the standpoint of accident prevention.

# STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

## Cumulative data

	Number	Per cent of recruits received	Per cent of recruits reviewed
JAN. 1 TO DEC. 31, 1930			
All naval training stations:			
Recruits received during the period.....	9,222		
Recruits appearing before board of medical survey.....	677	7.34	
Recruits recommended for discharge from the service.....	269	2.92	39.73
JULY, AUGUST, AND SEPTEMBER, 1931			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	422		
Recruits appearing before board of medical survey.....	4	.95	
Recruits recommended for discharge from the service.....	4	.95	100.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	659		
Recruits appearing before board of medical survey.....	6	.91	
Recruits recommended for discharge from the service.....	6	.91	100.00
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	781		
Recruits appearing before board of medical survey.....	7	.90	
Recruits recommended for discharge from the service.....	7	.90	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	453		
Recruits appearing before board of medical survey.....	24	5.30	
Recruits recommended for discharge from the service.....	3	.66	12.50

The following table was prepared from reports of medical surveys received during the third quarter, 1931, in which disabilities or diseases causing the surveys were noted as existing prior to enlistment. The time which elapsed from date of enlistment to date of medical survey is noted in each case. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office. The difficulty in establishing a diagnosis in nervous and mental cases is demonstrated by the time interval in the table. An exception in this group is epilepsy, which may or may not diagnose itself promptly. Certain groups, of course, present difficulties in diagnosis at the time of enlistment due to lack of equipment.

Cause of survey	Number of surveys	Number of days between enlistment and survey
Hernia:		
Umbilical.....	1	5
Inguinal.....	1	12
Neuropsychiatric:		
Epilepsy.....	1	6
Psychoneurosis, hysteria.....	1	75
Psychosis, manic depressive.....	1	48
Constitutional psychopathic inferiority, without psychosis.....	1	96
Tic (sternocleidomastoid).....	1	58
Diseases of lungs:		
Bronchitis, chronic.....	1	26
Diseases of eyes:		
Myopia.....	1	5
Hypermetropia.....	1	6
Diseases of ear:		
Otitis, media, chronic.....	1	2
Venereal diseases:		
Syphilis.....	1	47
Diseases of heart:		
Tachycardia.....	1	8
Valvular heart disease, mitral insufficiency.....	1	6
Do.....	1	5
Do.....	1	5
Valvular heart disease, mitral stenosis.....	1	2
Cardiac arrhythmia, extra systole.....	1	28
Genito-urinary diseases:		
Enuresis.....	1	96
Do.....	1	15
Do.....	1	125
Do.....	1	47
Do.....	1	34
Do.....	1	17
Deformities and diseases of extremities:		
Union of fracture, faulty (fifth metatarsal).....	1	4
Hallux valgus.....	1	6
Ingrowing nail (both great toes).....	1	13
Floating cartilage in joint, right knee.....	1	6
Flat feet.....	1	5
Do.....	1	1
Do.....	1	111
Malformation, congenital, right foot.....	1	7
Dental diseases:		
Caries, teeth.....	1	11
Do.....	1	3
Do.....	1	1
Do.....	1	1
Do.....	1	3
Miscellaneous diseases:		
Defective physical development.....	1	15
Do.....	1	8
Do.....	1	6

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# UNITED STATES NAVAL MEDICAL BULLETIN

PUBLISHED QUARTERLY FOR THE INFORMATION OF  
THE MEDICAL DEPARTMENT OF THE NAVY



*Issued by*  
THE BUREAU OF MEDICINE AND SURGERY  
NAVY DEPARTMENT



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NAVY DEPARTMENT,  
*Washington, March 20, 1907.*

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,  
*Acting Secretary.*

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Owing to the exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated.

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## SPECIAL ARTICLES

## PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, notes, and comments on topics of medical interest, and reviews or notices of the latest medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

*Surgeon General United States Navy.*



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Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without on understanding to that effect.

# U. S. NAVAL MEDICAL BULLETIN

VOL. XXX

JULY, 1932

No. 3

## SPECIAL ARTICLES

### RELIEF WORK FOLLOWING THE BELIZE HURRICANE

By T. L. MORROW, Lieutenant Commander, Medical Corps, United States Navy, and  
E. F. LOWRY, Lieutenant Commander, Medical Corps, United States Navy

Belize, the capital city of British Honduras, is situated at the mouth of the Belize River. The city is divided into segments by two canals some 14 feet wide which are drained by the river at one end and the sea at the other. The land is very low, having a mean elevation of 18 inches. Out to sea are a number of cayes; the nearest, St. George's Cay, is 9 miles from the city. It was the opinion of the inhabitants that the cayes would prevent a hurricane from destroying the city.

The population of Belize prior to the hurricane was 15,000.

With the exception of a few recently constructed, reinforced concrete buildings, practically all the construction consisted of wooden frame buildings on stilts and covered with zinc roofing. This type of structure added greatly to the hurricane and tidal wave hazard.

The city water supply comes from rain water which is stored in covered tanks; those of each residence care for their own tank.

There are a number of privately installed and operated sewage systems. This includes mainly the business and better residential section, but for the greater part of the population, sewage is disposed of by throwing it into the various canals which were constructed through the city just for that purpose.

The main food purchasing center for the residents of the city is a large native market located on the bank of the river near its mouth. Each day a large number of boats bring native fruits and produce. It is used by the natives not only as a market, but as a daily meeting place.

At the southern outskirts of the city was the St. Johns college, which was a large, 3-storied frame building. It was completely destroyed.

About one-half mile north of the college were the districts known as Yarborough and Mesopotamia; these were recently settled areas, and the buildings were all of the light frame type. It was at the college and these areas that the greatest loss of life occurred.

The city medical facilities prior to the hurricane consisted of the Belize General Hospital, of 200-bed capacity, under the charge of Dr. James Cran. The staff was composed of two English and one Canadian physicians. There was a nurses' training school connected with the hospital. The hospital was located on the northern side of the city and was of the usual adobe construction, except for one new wing, which was of reinforced concrete. The greater part of the roof was blown from these buildings during the early part of the hurricane and the entire floor of one ward was blown away. There were about 75 patients in this institution at the time of the hurricane.

The poorhouse for women was located about one-half mile northwest of the city. This building with its inmates was swept out to sea by the receding tidal wave and wind; not one of the occupants was found.

On the morning of September 10, 1931, the city of Belize was all decorated and everyone keyed up for a splendid celebration, it being the one hundred thirty-third anniversary of the "Battle of St. George's Cay," which was the last battle between the settlers and the Spanish. Prior to this battle the colony was claimed by both England and Spain. Days of civic, social, and religious festivity had preceded, and everybody was prepared to give the entire day to acts of celebration. This day will ever be sadly remembered; it marks the advent of the greatest calamity in the history of the colony—the destruction of the city and the blotting out of fully 1,500 human lives and injuring some 2,000 more.

In the short space of three hours, two hurricanes smote Belize and its environs, leaving death, destruction, and desolation in their wake.

At about 11 a. m., heavy rain fell, but even so, many school children gathered at the various schools to form the "school parade." The rain stopped for a while before noon, and then, with the winds rising, the school managers told the children to go to their homes as a big storm might soon break. Most of the little ones obeyed but some preferred to stay at the school grounds. In one case this meant a sad ending of youthful lives. About 2.20 p. m., the wind which had been blowing in gusts from the west-northwest, grew stronger, steadier, and wilder; within 20 minutes it blew a gale of 90 miles. Zinc roofing, slate, loose timbers from houses began hurtling through the air and into the streets. Many houses were blown off their supports, and crashed to ruin; in many instances the occupants were pinned under the tangled masses. The wind lasted for about an hour, when there was a period of comparative calm, and the people went out and began rescuing loved ones or friends from the wrecked

houses. Suddenly they observed water rushing toward the city from the southeast. It came with terrific speed, accompanied by a high wind, hurling barges, passenger boats, schooners, and motor boats high and far inland. These boats crashed against sheds, warehouses, office buildings, and homes, and in their own wreckage wrought other havoc. Following the tidal wave there came a violent gale from the south; its velocity reached over 100 miles and made deadly work of what the first storm had spared. Houses were hurled into the streets or smashed down like match boxes, shutters were crushed in by sheer wind force and sashes broken to pieces.

A pitiless flooding rain added to the horrors of the blast and darkness intensified the perils. Those in shelter could only huddle in dread and pray for safety. There was no way either to help oneself or to help others in the fury of the awful hurricane.

The raging tempest went up the Belize river and the country was lashed by it for many miles. About a half hour later the water left a mud deposit of 3 or 4 inches in every street and in every house that outlived the storm. The wind, the wave, and the ruins—all took heavy toll of human lives.

The rain kept falling heavily after the gale had ceased and darkness made all human efforts of alleviation of distress almost impossible.

The heavy blow was well nigh sufficient to kill all hope and stun human feelings. The material loss in Belize will go into millions of dollars, but the loss of lives is something far worse for the colony. Some families were utterly wiped out and many bodies taken to the sea by the tidal wave.

The terrific wind stripped the Tropical Radio towers of all wires, and the tidal wave flooded the motors; this left only a small set owned and operated by the Pan American Airways, and their motors were wet. Much credit is due Mr. L. E. Sherouse who worked all night drying the parts of their sending set. The first message informing the world of the terrible catastrophe was sent at 8.30 a. m., September 11, by Mr. Sherouse.

The American Red Cross responded immediately, and plans were made to have medical aid sent from the nearest available station, which was Managua, Nicaragua. About 4.30 p. m., on the 11th, a message was received from the Office of Naval Operations authorizing the commanding general to send two medical officers with assistants and medical supplies to Belize via airplane. In compliance, at 5.30 a. m., on September 12, two amphibians left with medical supplies, one medical officer (T. L. M.) and a pharmacist's mate; these arrived over Belize at 10.30 a. m. We circled over the city, which appeared from the air to be a mass of roofless buildings with

many of them lying on their side. Landing was made on the water and a boat conveyed all passengers and supplies ashore. We then reported to the colonial secretary, Hon. H. G. Pillings, and the chief medical officer, Dr. James Cran, both of whom were delighted over our early response to their call for assistance and welcomed us most cordially.

Doctor Cran requested that we establish a first-aid dressing station at the Scotch Presbyterian Church which was the only church left standing. Taking charge and with the assistance of Pharmacist's Mate, First Class, C. D. C. Taylor and two local nongraduate nurses we began caring for the injured. It was about 1 p. m. when we treated the first patient. At about 2 p. m. Chief Pharmacist's Mate C. L. Anderson from the U. S. S. *Swan* reported and rendered very valuable assistance.

At 4 p. m. a third plane arrived from Managua with additional medical supplies, Dr. E. F. Lowry, and Pharmacist's Mate, First Class, R. A. Hunt.

The city was under martial law and all persons were required to be off the streets at dark, so we closed at 6.30 p. m., and began work at 6 the following morning. As all available dry space at the hospital was crowded, 40 of the more serious cases were permitted to remain at the dressing station, using the pews for beds. On the second, third, and fourth days, the injured crowded our station all day and we were forced to work well after dark in order not to turn anyone away prior to receiving treatment.

Most of the injuries were caused by either flying zinc or slate roofing and consisted of lacerated wounds on various parts of the body, but principally the head and legs, all of which were septic. They appeared at the station with many types of primitive dressing, which had been applied by a friend or relative.

In view of the fact that disasters of this kind are not infrequent, and the medical officers most readily available will be called upon for relief, a brief description of the method of treatment employed is given. Each wound was carefully cleansed with boric acid solution, all necrotic tissue removed, and a wet alcohol-boric acid dressing applied; then each person was given 1,500 units of tetanus antitoxin. All of the worst wounds were cleansed and dressed twice daily. Under this procedure all wounds soon became healthy and healed rapidly.

During the first two days following the hurricane, a number of bodies were buried in the city cemetery. As time went on and the number of dead was found to be so much greater than the early estimate, the bodies were piled on wrecked houses, covered with kerosene, and burned. This procedure was necessary owing to the advanced state of decomposition of the bodies.





FIGURE 1.—RUINS OF ST. JOHN'S COLLEGE



FIGURE 2.—THE AMERICAN CONSULATE  
Boats washed inland by tidal wave.





Not a case of tetanus developed in anyone who received the antitoxin and over 700 injections were given at our station alone. However, there were two cases of tetanus on the seventh day after the disaster, among the injured who had not received the antitoxin.

On the afternoon of September 13, the U. S. S. *Sacramento* arrived at Belize. The medical unit from the ship consisted of the following: Lieut. George W. Cooper, Medical Corps, United States Navy; F. C. Frazer, chief pharmacist's mate, United States Navy; J. J. Vizard, pharmacist's mate, first class, United States Navy; and N. P. Kelly, pharmacist's mate, second class, United States Navy. Doctor Cooper and Chief Pharmacist's Mate Frazer were assigned to duty in the southern part of the city, caring for out-patients that were unable to walk, and in addition, the direction of sanitary work. The other pharmacist's mates assisted at the dressing station.

As there was no ambulance available, two large automobiles were designated as Red Cross cars for the purpose of transporting the injured to and from the dressing station; only those whom we considered should not walk were allowed to use the cars, and often it was necessary to carry a patient for blocks, due to the wreckage on the streets.

An emergency construction corps was furnished by the *Sacramento*, under the command of Lieut. Commander V. C. Barringer, United States Navy. One squad in charge of Chief Carpenter's Mate H. C. Gill, United States Navy, replaced the very much needed roof on the Belize General Hospital; another squad in charge of Boatswain's Mate, First Class, R. J. Stout, cleared away wreckage from some of the principal streets; a third squad, under the direction of Chief Machinist's Mate F. G. Corneau, overhauled and put into operation a large number of the urgently needed motor trucks and automobiles which had been useless due to salt water immersion. A detachment of United States Marines under the command of Lieut. C. W. Martyr was also landed from the U. S. S. *Sacramento* and assigned to patrol duty in the stricken city. This was done in order to give the overburdened police a chance to obtain some much needed rest. The first patrol went on duty at about 5 p. m., and the lack of lights proved a great handicap owing to the large amount of wreckage on the streets. The officers of the British Honduras defense force did all in their power to make the patrol as comfortable as possible—provided coffee for the reliefs and guides. A great portion of the responsibility of the patrol was the protection of thousands of cases of supplies that had been washed from the warehouses and scattered for blocks, and close watch of the principal shopping section, which the authorities feared might be raided. The work done by those men was urgently needed and proved a large factor in aiding the relief of the suffering, and received favorable comment from the local authorities.

The *Sacramento* brought medical and surgical supplies which were very badly needed; the supply officer, Lieut. L. V. Flavell, donated needed and well-prepared food each day.

The United Fruit Co. promptly responded to the call for assistance by sending Dr. R. B. Nutter and Dr. Ricardo Aguilar; these doctors worked at the hospital where all operations were performed and approximately 200 out-patients received treatment daily.

Doctor Sousse, four medical students, one nurse, and a Red Cross official reported on Monday from Guatemala City.

Hundreds of homeless were permitted to sleep in the Government buildings and cooked food was supplied to thousands for two weeks by the Salvation Army; milk was furnished to those with infants.

The water tanks were heavily chlorinated, as most of the covers were blown off, and no one knew how badly they were contaminated from the dirt of the streets or spray from the drainage canals.

Refugees left the city in large numbers, using every available means of transportation. For the relief of the unemployment situation, the clearing of the débris from the streets was taken in hand by the Government and shortly an average of 500 men with trucks were at work daily.

On the morning of September 14, 500 doses of tetanus antitoxin were received by plane from Miami; at the time of the arrival of this serum our supply was very limited. On the 18th, a Navy plane arrived from the Canal Zone with a large supply of surgical dressings and linen. All the supplies used at the first-aid station were furnished by the American Red Cross. We mention with much regret the sad accident which occurred to one of the Navy planes while en route from Coco Solo to Belize with medical supplies; this caused the death of three of the occupants and injured a fourth.

At the time of departure from Belize, 22 days after the hurricane, there had been no epidemic, and it is believed this danger is now over. Conditions are slowly improving, although the housing situation and water supply still leaves much to be desired, especially as it is the middle of the rainy season.

Under the able direction of the health officer, Dr. James Cran, the sanitary conditions in Belize will steadily improve.

### **MALIGNANT DISEASE OF THE LARGE INTESTINE<sup>1</sup>**

#### **REPORT OF FOUR CASES**

By J. A. BIELLO, Captain, Medical Corps, United States Navy

In presenting a few cases of malignant disease of the intestinal tract, this paper will be limited to a discussion of the salient features

<sup>1</sup> From the Surgical Service, United States naval hospital, Brooklyn, N. Y. Read before the Brooklyn Surgical Society, Dec. 3, 1931.

of malignancy of rarer occurrence; i. e., malignancy in the colon proper, excluding, for the sake of brevity, malignancy more commonly found in the rectum and stomach. In going over the list of cases that have come under observation at the naval hospital over a period of two years, it was found that there have been a number of cases of carcinoma of the colon. However, inasmuch as my own personal association with the hospital has been of only eight months' duration, there will only be considered in more or less detail the four cases which have been treated during this period.

At this point it might be well to give a few general remarks concerning the etiology, diagnosis, pathology, and treatment of this type of carcinoma.

Statistics show that out of a series of 888 cases of carcinoma of the intestines, 798 were in the large and 91 in the small—approximately 90 per cent and 10 per cent, respectively. Of those occurring in the large intestine, the rectum is attacked eight times as frequently as the rest of the colon. The distribution of the remainder involving the colon proper, in the order of frequency, are the sigmoid, the cecum, the splenic flexure, the hepatic flexure, and the transverse colon. We have had two cases of the rarest type, one which involved the ascending colon near the hepatic flexure, rare, not only in situation, but in type, in that it was an annular adeno-carcinoma of the lumen of the gut; i. e., a growth involving the entire lumen causing almost complete obstruction, there being but a pencil-size tract left open through the center of the tumor mass. The other involved the transverse colon near the splenic flexure with dense adhesions and metastasis, rendering removal of the growth impossible. As a general rule, malignant growths of the colon do not enlarge rapidly, and glandular involvement is rarely seen in their early stages. Statistics show that in more than 50 per cent of the cases dying of intestinal cancer there is no lymphatic involvement.

There is hardly another tissue of the body attacked by carcinoma in which there is such a tendency for the growth to remain localized as it does in the large intestine. In view of this fact alone, carcinoma of the colon offers an excellent field for the complete removal of the growth and offers the patient a happy chance of complete relief, if not complete cure. Unfortunately, however, we do not see cases of carcinoma of the colon as early in its development as we might. Its symptoms are so similar to the trivial maladies of the gastrointestinal tract, particularly in its early stages, that patients usually temporize with ordinary remedies, and only seek medical advice when their symptoms have not only persisted for months or even years, but have gradually become more and more aggravated, finally forcing them to seek relief when the growth has reached considerable size and caused considerable damage. This is also partly

true of carcinoma of the stomach where the disease is so insidious in onset and the symptoms so mild at first, that by the time the patient feels bad enough to seek medical advice, it is in a large number of cases inoperable. Statistics show that only in about 20 per cent of cases of carcinoma of the stomach is resection possible.

Sarcoma of the gastrointestinal tract is very rare, but when it does occur it attacks the young and spreads quite rapidly. It occurs principally in the large intestine, and we have in our series a case of inoperable neurogenic sarcoma involving a large portion of the mesentery of the small intestine occurring in a man 31 years of age.

*Etiology.*—Carcinoma still enjoys the realm of mystery; however, certain conditions, and particularly polypi, are known to have predisposed to cancer, either as a transformation of the polypoid tissue into cancerous growth or by the irritation set up in the wall of the intestine to stir it up into malignant activity. The studies and statistics of Hauser and later of Schmiesen, as quoted by Rankin,<sup>2</sup> have proved a direct sequence from polypi to carcinoma in over 140 cases, and established the fact that 40 per cent of cases of polypi develop into carcinomatous growths. Of other causes, taken purely from the clinical standpoint, we have to pay some attention to histories of long standing dysenteries, and colitis, particularly of the ulcerative type, as having some bearing at least upon predisposition to cancer or as acting as exciting factors.

The average age for carcinoma is given as 52; however, many of us who have been firmly imbued with the idea that malignant disease occurs only in middle age or after, find ourselves greatly mistaken if we pay but little attention to such signs as tenesmus, discomfort, constipation, and pain occurring in younger men. In the cancer ward, we have cancer of the rectum in two patients who are less than 35 years of age, and two cases of cancer of the colon in men of 39 and 36 years of age, respectively. The old adage therefore in telling a patient "you are too young for cancer" may have spelled the doom of many a man under 35, who has gone with unrecognized malignancy for many months or even years, and perhaps only seeking treatment when the tumor had progressed to the point of being inoperable.

Finsterer<sup>3</sup> believes that prognosis in cases of carcinoma occurring in younger men is much more serious, hence the importance of early diagnosis and treatment. In his series of 24 cases of resection in patients under 40, only 5 lived and were free from recurrence five years after operation. He believes that carcinoma is much more frequent in younger men than is usually suspected.

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<sup>2</sup> Rankin, F. W., *Surgical Treatment of Carcinoma of Colon*, Surg., Gynec. and Obst. 53: 229, August, 1931.

<sup>3</sup> Finsterer, H., *Year Book of Surgery*, 1930, pp. 450-451.

The writer, had the pleasure of meeting Doctor Finsterer in Vienna eight months ago, and watched him work, and was very much impressed with his remarks concerning early diagnosis and treatment. He believes that one of the reasons the surgeons do not see more cases of malignancy in younger men is because in many instances the family physician did not suspect cancer in such young people, and temporized with medical treatment. He is very thorough, and believes firmly that exploratory laparotomies are in order, when we have the slightest suspicion, after listening to the patient's history and family history, that malignancy may exist. He does all his work under local and splanchnic anesthesia, and I believe he is credited with having the lowest operative mortality in malignant disease of the abdominal viscera.

*Symptoms.*—There is no question but that the early recognition of symptoms of malignancy, the early investigation of these symptoms, and the early treatment of these cases contribute more to better results from operative procedure than any other factor. The unfortunate thing about malignancy of the abdominal viscera is that the symptoms are so mild in their incipency, that many months elapse before the patient believes that the slight but increasing discomforts are sufficiently alarming to signify anything serious, and come to operation usually from 6 to 18 months or more after the onset of the initial symptoms.

Symptoms, of course, vary according to the location of the lesion. In rectal cases, bleeding is usually the first sign of trouble, and while the passing of blood usually impresses the patient that something serious must be wrong more than any other symptom, even then, considerable valuable time is allowed to elapse before the condition is considered serious. Carefully taken histories in cases of bleeding invariably will reveal that there was a period of time preceding the bleeding during which tenesmus, discomfort, or actual pain was present but to which the patient paid little attention. This prebleeding period is usually from one to three months, during which time the tumor was present but unsuspected, and it is only after such a period of tumor development that ulceration occurs, and bleeding takes place. The preulcerating or prebleeding signs are unfortunately looked upon not only by the patient but in many cases by their physician as well as of no serious significance, and only when bleeding and continuous bleeding occurs will they even suspect the possibility of cancer. In fact, there are a few cases on record in which hemorrhoidectomy has been performed for "bleeding piles" when the real source of trouble was cancer.

With the location of the mass higher up in the colon, bleeding becomes even a rarer early symptom. Obstinate constipation, irrita-

tion, or diarrhea alternating with constipation, are the earlier signs to be looked for. Pain, while present in the majority of cases, usually makes its appearance late in the chain of symptoms.

When the lesion is situated still further up the descending or in the transverse colon, bleeding becomes quite rare. Here distress leading to pain in the lower abdomen and constipation are slow in developing and several months will pass before they cause the patient to realize his or her plight. Indeed, quite a number of these patients have sustained loss of weight and weakness and have palpable masses before seeking advice. Such, at least, has been the case with three of our patients.

The early abdominal pain was usually attributed to dyspepsia. In many cases, obstructive symptoms due to the increasing size of the growth will make their appearance and continue for weeks and months before a diagnosis is made.

Occasionally a history is given of phantom tumors; tumors which the patient described as being palpable but later disappeared; these were no doubt fecal impactions to the proximal side of the constriction, which vanished following the liquefaction and passing of the fecal mass through the stenosed portion of the gut. The colon can accommodate itself to a marked degree of narrowing and not produce any marked symptoms of obstruction. In one of our cases, as already mentioned, the tumor, an annular adeno-carcinoma, completely filled the lumen of the colon at the hepatic flexure with only a very narrow passage through its center, and yet the patient got along for many months without true signs of obstruction.

In growths of the transverse and ascending colon, weakness and anemia, which are difficult to account for, as there has been no visual loss of blood, are prominent characteristics of the clinical picture. This anemia is slow but progressive, and is the result of impairment of the physiology of the colonic mucosa with the subsequent absorption of toxins. Blood in or on the stool is quite significant of the presence of carcinoma distal to the splenic flexure, but as a rule no blood is to be found in the stool of patients with lesions in the transverse or ascending portions of the colon.

Our especial attention to early signs and investigation as to their significance in relation to malignant disease, becomes, therefore, our paramount aim if we are to successfully combat the ravages of cancer.

X ray should be part and parcel of any diagnostic investigation, however, it should be considered of value only when positive in its findings. In other words, an X ray which is apparently negative, should not lead us to abandon the thorough investigation of the clinical signs, as statistics show that many errors have been made in cases of negative X-ray findings in which cancers of the colon and



recto-sigmoid were proved to exist. We have only to remember that the X-ray film represents but a few seconds of time in the function of the bowel and does not give us a complete picture of the continuous physiological action which is bound to vary from hour to hour.

*Prognosis.*—Little can be said. Naturally the earlier the diagnosis, the earlier the treatment, the better the prognosis. Jones<sup>4</sup> states that only 25 to 50 per cent of all cases seen are operable; 40 to 50 per cent live comfortably for a few years following palliative treatment in the form of cholestomy or cecostomy as the case may be. At best, it is poor. The statistics of Finsterer<sup>5</sup> show that early resections in cases with little or no metastasis the mortality rate is less than 10 per cent. As to recurrence, he claims that a reappearance of the tumor after a period of five years following operation is probably a new growth and not a recurrence or a late metastasis. In favor of this theory is the fact that the original site having been resected well beyond the diseased area, any irritation on a distant part from the original tumor, such as the stoma of an anastomosis will produce a carcinoma in a subject who is already predisposed to cancer. Furthermore, in a few cases of the so-called recurrences, histologic examinations of the specimen proved it to be a different type of tumor, and he comes to the conclusion that return of cancer after five or more years is not a recurrence, but a new growth, the result of weakened defensive powers of the patient against cancer.

*Treatment.*—Before passing to the surgical treatment of cancer of the colon, let me briefly outline some of the palliative methods that have been advocated from time to time.

Of the Coffey-Humber treatment, which has been vaunted in the past few years in the newspaper, little or nothing has been written in the medical journals, except very recently. A lengthy article appeared in the journal of the American Medical Association<sup>6</sup> recently reporting something over 400 patients with various degrees of carcinoma and sarcoma distributed in such organs as the breast, uterus, rectum, stomach, etc., that were treated by this method. The report in general goes to show that practically no benefit was derived from the treatment, which consists of injections of the suprarenal cortex extract. The greatest number of the patients lost weight under its administration. Pain was not relieved to any appreciable extent by the use of the extract. The percentage of

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<sup>4</sup> Jones, D. F., The Diagnosis and Principles of Treatment of Carcinoma of the Colon and Rectum. *Annals of Surgery*, 94: 860, November, 1931.

<sup>5</sup> Finsterer, H., *Year Book of Surgery*, 1930, pp. 450-451.

<sup>6</sup> Harris, R. H., The Coffey-Humber Extract of Suprarenal Cortex Substance: A clinical study of 415 patients with malignant tumors who received experimental injections. *J. A. M. A.*, 97, 1457, Nov. 14, 1931.

deaths was essentially the same. Microscopic studies made from autopsy specimens from cases that had received the injections compared with specimens from cases that had not received them, revealed nothing in the way of difference in the essential microscopic findings. In other words, there was no difference in the necrosis and sloughing of the tumors in the cases that had received the treatment than in the cases that had not been so treated.

Colloidal metals, principally colloidal lead, have been tried and found wanting. Lately colloidal lead phosphate with manganese has been tried; the first report of a perfected preparation of this compound was published in 1929.<sup>7</sup> Experimentation upon animals at the Croker Institute of Columbia University revealed that its effects upon cancerous and normal tissues was of negligible concern. No change occurred in blood pressure nor in the blood count except an increase in the white blood count was noted, in some cases up to 18,000. The outstanding feature of this new preparation is that it is well borne by the patient. The reaction following its administration consisting of a marked chill, rise in temperature to 100° or 101° F., and some nausea, all of which abated within a period of a few hours. Radium treatment, of course, maintains its reputation both when used alone or as an adjunct to other methods of treatment. Surgery, however, is still our paramount weapon against cancer.

As to preoperative care, one has only to remember that the most common fatal factor in operations upon the colon involving resection is peritonitis, and in order to prevent a catastrophe from this cause, it is not only essential for the practice of scrupulous care and technique during the operation itself, but to so prepare the patient as to reduce the chances of this menace to a minimum. In this connection, peritoneal injections of a vaccine of colon bacilli and streptococci has been used in many large clinics including the Mayo Foundation as a preliminary step to operation in order to prevent the hazard of peritonitis. This, however, is not generally done and it has not been done at this hospital. The proper rehabilitation of the patient, as a preoperative measure becomes a necessity of the primary importance. The selection of the proper operative procedure to fit each case rather than a standardized operation demands careful study of the individual case, and the question of a single stage or 2-stage operation is of great importance. The choice of anæsthesia is of equal importance. At this hospital spinal anæsthesia is the choice unless distinct contraindications exist. As you well know, practically all the patients suffering with carcinoma of the intestines have acquired a lowered resistance, partly from the ravages of the disease itself, and partly from the dehydration as a

<sup>7</sup> Kraemer, W. H., Preliminary Report on Colloidal Lead Phosphate with Manganese, *Am. J. Cancer* (supp.), 15: 2357, July, 1931.

result of obstruction with its subsequent absorption of toxins. The rehabilitation prior to operation, therefore, should be directed toward the correction of these conditions with suitable large intakes of fluids, high colonic diet, and even blood transfusions with frequent rectal irrigations plus mild purgation for the decompression.

The two chief considerations in dealing with the treatment of a malignant growth of the intestines are:

1. The pathology and pathological anatomy of the growth.
2. The blood supply of the parts involved.

It is well known that the virulence of a malignant growth is least in the large intestines than elsewhere, because the development of the tumor is very slow, the invasion of the lymphatics is delayed beyond the time of invasion of lymphatics in other areas, and that metastatic involvement is rarely, if ever, found in early recognized cases.

The blood supply is of paramount consideration, the careful selection of the point at which the arterial supply is to be ligated, must constantly remind us that this is far more important than is the selection of the type of anastomosis, the kind of suture material, or the kind of stitch to use. A beautifully performed anastomosis will go to naught with disastrous results if the blood supply to the distal and proximal segments fail to function. The life of the patient depends upon the accuracy of placing the tie on the vessels at the proper place, more so than any other factor in the technique of the operation.

#### CASE REPORTS

**CASE 1.**—A. M., age 41, admitted April 4, 1931, with diagnosis undetermined (appendicitis, acute).

*Family history.*—Mother died of cancer of the breast.

*Present illness.*—Pain in epigastrium of 10 months duration. Said that he had passed some blood in the stool five months ago and had occasional vomiting after meals since that time. Was in another hospital seven weeks prior to admission, where a diagnosis of peptic ulcer was made. The pain complained of had no relation to time, quality, or quantity of food. Lost 35 pounds in 10 months.

*Gastrointestinal series* made on April 25, 1931, was practically negative with findings of slight tenderness over the cecum and appendix and with no fixation or restriction of the colon, and a note to the effect that the trace of gastric residue is probably due to iliocecal reflex.

*Operation* on April 29, 1931, under spinal anesthesia, revealed a mass at the hepatic flexure of the colon about the size of a large orange, quite firm, but freely movable. Apparently no metastasis. Distal to the mass the colon was somewhat distended with feces. Resection was made from the terminal ileum to about the center of the transverse colon, followed by anastomosing the end of the ileum to the side of the colon on the longitudinal band. Specimen showed a dense anular growth filling the entire lumen except a pencil-size opening through its center.

*Microscopical report of the tumor mass.*—A tremendous proliferation of the lining epithelium of the tubular glands. There are many solid masses of cells.

There are numerous anaplastic and hyperchromatic cells seen. The stroma is infiltrated with numerous plasma cells, neutrophilic leukocytes, and lymphocytes. There are many congested capillaries present.

*Diagnosis.*—Adenocarcinoma.

Patient made an uneventful recovery. Seen six months after the operation and was apparently in excellent condition, and no signs of recurrence.

*CASE 2.*—C. B., age 35, admitted September 2, 1931.

*Family history.*—Father died of unknown cause. Mother living and well.

*Present illness.*—For the past three months has had pain in lower abdomen, colicky in nature, and lasting two to three minutes at a time. Obstinate constipation for the same period. No blood in the stool, and the pain had no relation to the intake of food. Has lost considerable weight and presents a cachectic appearance.

*Gastrointestinal series* taken September 11, 1931, was negative for stomach pathology. Duodenum showed diminished peristalsis. Duodenum and ileum showed incomplete patency with obstruction and retention at 80 hours. Incomplete obstruction of jejunum and ileum. Malignancy was suspected.

*Operation* on September 24, exploratory under spinal anesthesia, revealed a hard bound down mass in the hepatic flexure of the colon, thoroughly fixed, with glandular involvement. The cecum and terminal ileum were distended and firmly adherent to the posterior abdominal wall and to the surrounding parts. Glandular metastasis present. Case was considered inoperable and an ileostomy was done for the relief of obstruction. A gland was removed for biopsy.

*Histopathological findings.*—Sections show many neutrophilic leukocytes, epithelial cells and large nucleated cells. Many of the large epithelial-like cells appear hyperchromatic and few show mitosis. The lymph node is not primarily involved, but the area around the node is definitely involved with neoplastic tissue.

*Diagnosis.*—1. Chronic lymphadenitis. 2. Metastatic carcinoma.

*CASE 3.*—J. A. C., aged 39, admitted September 18, 1931.

*Family history.*—Father died of bowel trouble. Mother died of carcinoma of uterus. Two brothers died of pneumonia. One brother and two sisters living and well.

*Present illness.*—Gives a history of constipation for the past 15 years. Began to feel unwell about a year ago. Could not properly describe symptoms, but felt something constricting in his abdomen, but was able to carry on with his work. About two months ago began to have pain in the back and abdomen which became severe and had to stop work. Indigestion and severe constipation appeared at this time and patient located a mass in his abdomen which was not painful in itself. No vomiting and no blood in stool. Had gas pain with distention. Lost about 25 pounds in last three months.

*Gastrointestinal series.*—Stomach quite fixed with lower pole of greater curvature  $1\frac{1}{2}$  inches above the interspinous line and 3 inches to left of median line. Large irregular filling defect of transverse colon with diminished mobility.

*Diagnosis* of carcinoma was made. At the Memorial Hospital, New York, the diagnosis was confirmed and the recommended treatment was relief of obstruction followed by radium or X ray.

*Operation* on November 12, 1931, under spinal anesthesia. After opening the abdomen through a right rectus incision, about a gallon of milky fluid was removed. The transverse colon was bound down by a dense hard mass firmly adherent to the posterior abdominal wall and surrounding tissues, and extended above the transverse colon. The size of the mass was about 7 inches in dia-

meter. In view of this extensive involvement, resection considered impossible, a cecostomy was performed for the relief of the obstruction.

This is undoubtedly one of those rare cases of multiple carcinoma of the colon which have occasionally been found and the lesions are regarded as separate malignant growths arising from their own epithelial basis rather than being metastatic. Bargaen and Rankin,<sup>\*</sup> in a splendid article, have reported 16 cases of their own and collected some 196 others in which multiple primary malignant lesions occurred not only in the same individual, but in the same organ.

CASE 4.—W. J. N., Age 81, admitted November 10, 1931.

*Family history.*—Negative.

*Present illness.*—One month prior to admission began to have pains in the right side of his abdomen radiating to the left side. Pain more severe three or four hours after eating. This pain has been growing more in severity since then. Has two or three soft stools a day with no blood. No nausea and no vomiting. Palpation revealed a firm abdomen, giving the impression of a large mass not freely movable. Malignancy was suspected and an exploratory operation recommended.

*Operation* on November 12, 1931, revealed the presence of a large mesentery tumor involving practically the entire mesentery of the small intestine and extending right up to the attachment of the bowel, hard in consistency and thoroughly fixed. Case was considered inoperable and a biopsy specimen was obtained.

*Histopathological diagnosis.*—Tissue resembles a ganglion. Many medullated nerve fibers and many nonmedullated fibers found in longitudinal and cross sections. A few large multipolar cells showing dendritic or axonic processes. These nerve elements appear to be growing wildly and rapidly. Definite signs of degeneration not seen. Many cells appear to be fibroblasts while others are round and oval.

*Diagnosis.*—Ganglioneuroma of sarcomatous type.

The slides were sent to the Memorial Hospital where the diagnosis made was neurogenic sarcoma, and the recommendation of the staff at Memorial Hospital was repeated doses of X-ray therapy about six to eight weeks apart, with the idea in view of producing fibrosis of the tumor.

This type of tumor may be found at any age. Its malignancy depends upon the differentiation of cells and with increasing age of the individual the malignancy usually decreases. Youth is favored, but no age is spared. The size varies from that of a plum to that of a man's head. These tumors are grouped under the adrenal tumor group, and are evidently derived from the sympathetic system. Malignancy is favored due to lack of signs of degeneration and the rich blood supply present.

#### DISCUSSION

Dr. EDWIN H. FISKE. I feel we can not speak too frequently of the existence of cancer outside this cancer age that we all know of, namely, between 50 and 60, when cancer is so prevalent. We must keep that in mind. These people, every one of them, will give a history of illness or indefinite symptoms for months, and based upon that the physician and the surgeon should pursue a more persistent search for carcinoma of the large intestine, particularly this type of carcinoma of the large intestine which, as so well stated, offers such a promising field for surgical work.

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<sup>\*</sup>Bargaen, J. A., and Rankin, F. W., Multiple Carcinomata of Large Intestine. Ann. Surg., 91: 583, April, 1930.

The question of recurrence spoken of is a very interesting one because of the fact that Finsterer thinks and says (and perhaps he is right) that the recurrences which we get in the late carcinoma cases are not recurrences at all but new growths. I don't know what to say to that, except to remark that it has always been a marvel to me, as it was about six months ago when a lady came back to me after an operation 18 years previously for carcinoma of the rectum, with carcinoma of the pelvic bones, and, of course, I took it for granted that it was a late metastasis developing from her original adenocarcinoma of the rectum; and yet it may be that Finsterer is right in asserting that after a period of five years these are new growths, because, after all, the great question in such a long drawn-out period from the time of discovery of the original tumor to that of the metastasis makes one wonder where in the word the carcinoma has been resting during all that time, and it is, of course, resting.

We had considerable experience with the Coffey-Humber serum, or solution, or adrenalin cortex, and must agree with what the doctor said, that in no case could we really and truly say that the Coffey-Humber serum offered to the patient any improvement in the carcinomatous condition. The only slight thing that we seemed to get in these cases was a feeling of well being, which often comes to the carcinoma cases if you do something to them and persistently do something to them; it encourages them.

An idea that is interesting me particularly and also a group of us at the Kings County Hospital who are thinking and trying to work on carcinoma is the question of alkalosis and a marked calcium deficiency in carcinoma cases. We have only had a few cases, six to be accurate, in which we have pursued this investigation (they have all been postoperative cases, unfortunately), and they have all persisted in an alkalosis and a calcium deficiency before operation, but the ones I am speaking of particularly have persisted, following operation, in an alkalosis and a calcium deficiency. There has been some experimental work done on the matter, but as yet it is too limited to offer anything conclusive. However, if it is an element in the production of cancer it may be that it certainly is an element in the production of recurrence of cancer. Therefore, I think more of us should study this question and report on it. Certainly, I believe, it would pay us to examine carcinoma cases along these lines and perhaps during their convalescence add to our X-ray and radium therapy the treatment of the alkalosis and calcium deficiency.

There is one other thing that has come into the treatment of carcinoma, particularly of the large intestine which I can not forego mentioning, and that is the electric scalpel. I think the electric scalpel possesses the advantage of destroying some of the carcinoma cells, or elements that we may leave behind in our operating procedure and blocking off the lymphatics. That is another piece of work which I think we must pursue with a great deal of interest and intenseness so as to arrive at some conclusion as to its value.

And, then, too, I speak of radiation, as the doctor did and as we all think, in the carcinoma cases to-day perhaps with a little less courage and a little less hope than we had some years ago, but we must persist in the use of radiation postoperatively, particularly in such cases as those where we can not complete our work and where we can hope for some fibrosis, some shrinkage, some improvement in large intestinal tumors from radiation, and if you take a carcinoma of the colon that seems inoperable, such as the one the doctor described to us, and do your colostomy on the case you certainly relieve to a great extent the inflammation and the subsequent tumefaction that follows from the inflammation around them, and then, if you pursue radiation therapy

in addition to colostomy, a marked improvement is brought about in the size of the tumor and in the operability of the case.

In regard to lymphosarcoma of the ganglioneuroma type: Lymphosarcoma is one type of malignancy and the ganglioneuroma is not unlike the lymphosarcoma in its cell virulency, and I hope this ganglioneuroma will prove to be the most amenable tumor to X ray and to radium. I know, personally, of three individuals who are alive to-day, one of them for 15 years, who had an immense retroperitoneal sarcoma which was diagnosed, operated upon in an attempt at removal, but at operation this was found impossible, and Dr. Calvin Barber, who operated upon the case, simply did a biopsy and sarcoma was diagnosed. That case received X-ray treatment subsequently, and since then he has remained absolutely well and healthy with no evidence of any tumor 15 years after the growth that was in the early stage of the disease. That patient has been under the care of Doctor Phaler, of Philadelphia, since then. I know of two other cases of lymphosarcoma that have been apparently cured by X-ray therapy, and thinking of this one type of growth alone encourages me in always insisting upon radiation treatment of these other cases which react less favorably, but react to a certain extent to such therapy.

Dr. ROBERT F. BARBER. Symptoms arising in the large bowel are baffling. Many of us have more or less digestive or functional disturbances, such as bellyaches, gas, and other things that we pay no attention to. I have had surgeons who have been victims and could not diagnose their own carcinoma, the outstanding thing which brought them finally to the operating table being intestinal obstruction. To be sure, it was not severe. But that is what they finally came for, intestinal obstruction. The outstanding symptom, occasionally is progressive anemia. I have seen that in a young woman where it was found to be due to carcinoma that never rose to the threshold of observation. She had no symptoms in the abdominal cavity, she never knew she had any disturbance in the abdominal cavity, and the condition was discovered in the course of a physical examination. The tumor was large enough to fill the entire pelvis.

I do not know what we mean by early diagnosis of carcinoma of the large bowel in these cases which are so deceptive and so misleading. I wish we could have some test for malignancy to indicate to us that there is a malignancy in the body, a test, for example, where we could run through a hundred cases and say there are only two where we are dealing with malignancy. In deep malignancy I do not believe we can expect any aid from X-ray therapy. In the report of the committee appointed by the American College of Surgeons on cancer of the breast, for instance, the conclusion of that committee was that the preoperative radiation of carcinoma of the breast is of no value; that postoperative radiation is of no value; and that the only use of X ray in carcinoma of the breast is to hold in abeyance the skin metastases which may appear after operation. I believe they are coming more and more to the conclusion that deep malignancy is not amenable to X-ray therapy.

In regard to the stage operation, the first case the doctor reports was done in one stage, and in discussing his paper I would like to ask him if he would not elect another time to do that case in two stages, in order that he might have a safety valve at the appendix and have the bowel better prepared for a resection and an anastomosis. As the case turned out, the way he did it was right, as the patient got well and is well to-day.

In reference to the third case, he did not mention whether or not a biopsy was removed. In all inoperable cases we feel that a biopsy should be removed. The practice of removing biopsies was held back for years and years because

it was taught that biopsies increased the spread of malignancy, the rate of metastases, and that they were absolutely vicious and should never be done. Now everybody does them. The experimental work of Doctor Wood with mice showed conclusively that biopsies in no way interfere with the natural biological history of carcinoma, the rate of growth, or the rapidity of metastases.

Doctor BIELLO. The question asked regarding the one or two stage operation is an important one. In this particular case the general condition of the patient was excellent. As I stated this man came to us at a time when he was actually able to palpate his own tumor. The reason I elected the 1-stage operation was because I decided to do a rather extensive resection; that is, from the terminal ileum to the transverse colon, rather than to limit it to a resection of the mass itself, inasmuch as the backward pressure at the proximal end of the ascending colon was not great, even though the lumen of the gut had been so narrowed as to only be of pencil size, the feces were sufficiently liquid to pass through without giving the patient any symptoms of obstruction. The ileum and the transverse colon were in excellent condition, and inasmuch as I was going to take out the entire ascending colon, I felt that an anastomosis between the terminal ileum and the transverse colon would give better results than an anastomosis between the adjacent portions of the colon itself. I agree, however, that in some cases the 2-stage operation is the better procedure, at least, you would have a safety valve, as mentioned, to release the pressure against the suture line, which is very important. As a matter of fact, in a good many cases in which the 1-stage operation is done some surgeons elect to do the Wutzel method of tubing the proximal end of the bowel in order to allow a certain amount of fecal current and gas to escape prior to reaching the suture line.

In regard to biopsies, I regret if I omitted to mention at the time I was discussing the case, the fact that we removed a specimen for biopsy in each of the inoperable cases.

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### RABIES<sup>1</sup>

#### REPORT OF FOUR DEATHS RESULTING FROM BITES ON THE FINGERS BY THE SAME RABID ANIMAL

By J. E. FETHERSTON, Lieutenant Commander, Medical Corps, United States Navy, and  
GEORGE F. COOPER, Lieutenant, Medical Corps, United States Navy

On November 14, 1931, a patient, J. M. J., coxswain, United States Navy, was admitted to the hospital from the U. S. S. *John D. Edwards* with a diagnosis of acute gastroenteritis.

Upon being questioned the patient stated that his illness began two days previously with vomiting, which occurred each time he attempted to swallow. At the same time his left arm became painful. These symptoms became worse and at about 2 o'clock the morning of admission he began to have chills, profuse perspiration, shortness of breath, and pain in the chest.

In the course of obtaining his history it was revealed that he had been bitten on the hand by a dog while the ship was at Chefoo, China,

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<sup>1</sup> From the Medical and Laboratory Services of the United States naval hospital, Canacao, P. I.



about a month before. His condition became steadily worse, and he died of rabies the same day.

The following day, November 15, 1931, seven other men were admitted to the hospital from the same ship for observation and treatment. These men claimed that they had been bitten by the same dog and had reported the fact only after they had heard of the death of the coxswain.

The dog had been smuggled on board the ship by one of the occupants of a late liberty boat, and the coxswain, who attempted to pat the dog on the head as the animal was being brought on board, was the first to contract and die of the disease.

All seven men were immediately placed on antirabic treatment.

One of the seven at time of admission, J. A. B., complained of numbness. He rapidly developed symptoms of rabies and died the next evening.

Two days later, another member of this group, E. J. Z., complained of dizziness, and died within 48 hours of rabies. He had received four injections of antirabic vaccine.

On the same day that this patient died the last man to develop the disease began to show early symptoms and died of rabies two days later. He had received six injections of antirabic vaccine up to the time of his death.

Detailed histories of the four cases, with the symptoms and the findings noted, are as follows:

#### CASE REPORTS

**CASE 1.**—J. M. J., coxswain, United States Navy, admitted with a diagnosis of gastroenteritis, acute, on November 14, 1931. His chief symptoms on admission were chills, difficulty in swallowing, and dyspnoea. Illness began two days ago with vomiting, which occurred each time he attempted to swallow. At the same time his left arm became painful. He rapidly became worse and was sent to the hospital at 7.30 a. m.

On being questioned he volunteered the information that he had been bitten on his left index finger by a dog in Chefoo, China, about 30 days previously.

When examined he had the appearance of being acutely ill, was having difficulty in swallowing and in breathing, and was shaking as if having a chill. Physical examination was essentially negative except for large bubbling râles over the entire left chest, and a small dark scar on the left index finger from the dog bite. Temperature 98.8° F.; pulse, 78; respiration, 18. White-cell count, 24,000; neutrophils, 86 per cent. Spinal fluid was clear, not under pressure, and negative serologically and bacteriologically.

During the afternoon the spasms became more frequent and severe, and it became necessary to give frequent injections of morphine in an effort to control the spasms of his neck and chest muscles.

2 p. m.: The patient had another attack of what appeared to be a chill, with difficulty in breathing and swallowing. He seemed to be sensitive to air currents on his skin when the bed clothes were removed. Perspired freely.

3 p. m.: Appeared to be restless and uncomfortable. Quantities of frothy saliva drained from his mouth, apparently from his inability to swallow it.

The patient became progressively worse and died at 7.20 p. m. An examination of the brain showed the presence of Negri bodies.

CASE 2.—J. A. B., gunner's mate, third class, admitted November 15, 1931, complaining of numbness. Shortly after receiving his first injection of antirabic treatment, he complained of difficulty in breathing and swallowing. There was a sense of constriction about the neck and chest and fear of water. He stated that he first noticed these symptoms when he heard the sound of water running in the bathroom and that the sound caused him to have spasms in his neck muscles.

Examination revealed an acutely ill patient, apparently somewhat hysterical. His eyes, like those of the other cases, showed extreme dilatation of the pupils. He was frothing at the mouth, and this appeared to be due to inability to swallow saliva that collected in his mouth during the severe spasms. When asked to take a drink of water, he replied that he could not, and began to have spasmodic contractions of the throat muscles.

On November 16, the morning after admission, the white-cell count was 11,700, with 80 per cent neutrophiles. Later in the morning the leukocyte count was 16,100 with 89 per cent neutrophiles.

At 2 p. m. he had a severe attack accompanied by dyspnoea and great mental excitement. He seemed to be able to inspire air, but in order to do so it was necessary for him to throw his arms above his head and in that way lift the chest. There was frothing at the mouth, and at no time was there a definite act of swallowing. Due to repeated spasms of the jaw and throat muscles there was a large amount of this frothy saliva.

He had several severe attacks, but between the paroxysms was able to talk and answer questions. During these periods his muscles were relaxed and he seemed to be comfortable.

As the disease progressed the mental symptoms increased, so that he finally became maniacal and had to be restrained in a straight jacket. He was given 240 milligrams of neocaine intraspinally and  $2\frac{1}{2}$  grains of morphine hypodermatically, but in spite of this he remained excited and 45 minutes after giving the spinal anesthesia got up out of bed. Later he began to show evidence of cyanosis, which increased until death occurred at 9.27 p. m. White-cell count shortly before death was 50,000, with 89 per cent neutrophiles. The brain showed the presence of Negri bodies.

CASE 3.—E. J. Z., quartermaster, third class, admitted November 15, 1931, for observation and antirabic treatment, because of a dog bite one month before. The patient appeared normal when admitted. He had a scar on his left fourth finger from the bite. Physical examination otherwise was negative.

November 17, two days later, he complained of dizzy spells with a slight headache. White cell count 6,000, with 65 per cent neutrophiles.

November 18: In the morning, while attempting to wash his face, the patient stated that the sight and "smell" of water nauseated him. He tried to take a drink of water but found that he could not swallow. White cell count 7,200, with 64 per cent neutrophiles and 33 per cent lymphocytes.

1 p. m.: Was able to drink one small bowl of soup and small amounts of water and milk, the latter with slight effort. The water caused great difficulty and spasm and could only be taken with eyes closed. White cell count at 2 p. m. was 8,400, with 72 per cent neutrophiles and 25 per cent lymphocytes. Temperature, 101.2° F.

5 p. m.: Asked for a glass of milk, but had great difficulty in drinking it.

9 p. m.: Very restless. Twenty cubic centimeters of blood serum, from a man who had completed a course of antirabic treatment within three months, was

given intraspinally in the hope that it might be of value. At the time of the injection the patient became very violent and apparently was suffering from intense meningeal irritation. He had to be restrained and chloroform administered to quiet him. At the same time he received the serum intraspinally; he was given 30 cubic centimeters of the same serum intravenously.

11 p. m.: Began to show definite improvement—frothing at the mouth had stopped and he was able to talk rationally. White-cell count at this time was 20,800, with 78 per cent neutrophils and 21 per cent lymphocytes.

November 19, 2 a. m.: Given 45 cubic centimeters of blood serum intravenously. This serum was from another donor but was cross-typed for record. The patient continued to improve and was able to joke with those present. His white count was 43,300, with 85 per cent neutrophils and 14 per cent lymphocytes.

4.30 a. m.: A complete blood count showed the high degree of dehydration suffered by this patient: Red blood cells, 7,300,000; hemoglobin, 100 per cent; white blood count, 61,200; neutrophils, 91 per cent; lymphocytes, 9 per cent. A few hours later 40 cubic centimeters of a 50 per cent glucose and 750 cubic centimeters of normal saline were given intravenously. The pulse at the time was 130; respiration, 30. The patient's condition remained unchanged until 7.30 a. m., when a definite right-sided paralysis appeared and he became cyanotic, dying at 8.27 a. m. The brain showed the presence of Negri bodies.

CASE 4.—H. B. L., fireman, first class, admitted on November 15, 1931, for observation and antirabic treatment. There were no symptoms present.

He stated that he was the engineer of the motor launch in which the dog was brought to the ship. In attempting to pat the dog's head, which was sticking out of J. A. B.'s (the second patient to die) coat, he was bitten on the right index finger. There was a small scar on his finger. White blood count at this time was 8,800; neutrophils, 68 per cent; lymphocytes, 27 per cent.

November 18: No symptoms. White blood count, 8,200; neutrophils, 60 per cent; lymphocytes, 33 per cent.

November 19: Claimed that he was not hungry, although he was able to eat regular meals.

November 20: At 4 a. m. the patient felt nauseated and vomited. White cell count 9,300, with neutrophils 75 per cent and lymphocytes 20 per cent. Examination showed his pupils to be widely dilated. The left pupil was sluggish in its response to light. His pulse was full and regular but not rapid. Respirations were normal. Complained of a tingling in the right arm, which he first noted yesterday. Stated that when he would lie on his left side and then get up suddenly, he would become very dizzy. At the time these symptoms began the patient had received six injections of antirabic vaccine.

9 a. m.: Given 40 cubic centimeters of serum from a patient who had completed a course of Pasteur treatment three weeks previously and which consisted of 25 injections.

1 p. m.: Forty cubic centimeters of serum was again administered, intravenously. The patient had no reaction to the serum, and was apparently comfortable, sleeping most of the day. He was easily awakened, and when asleep muscular twitchings were noted in the upper extremities. He was able to drink milk and soup. White blood count, 9,350; neutrophils, 80 per cent; lymphocytes, 20 per cent.

2 p. m.: The patient attempted to drink water, and a slight unsteadiness was noted. However, he was able to swallow it by taking large mouthfuls as though in a hurry to get it down. Blood serum was again given at 7 p. m. and 1 a. m.

November 21: At 7 a. m. the patient tried to drink water and began to have severe throat spasms, followed by considerable mental excitement. As the morning went by definite signs of respiratory involvement were present, with forced inspiration, expirations being slow and quiet. He became very apprehensive and watched any movement taking place in the room. White blood count 12,400, with neutrophils 91 per cent and lymphocytes 9 per cent.

In the afternoon his symptoms increased but patient was never maniacal, being able to talk quite rationally. Respiratory embarrassment increased, pupils contracted, temperature increased to 108.2, and the patient died quietly at 9.10 p. m. The brain showed the presence of Negri bodies.

#### DIAGNOSTIC POINTS NOTED IN ALL FOUR CASES

*Eyes.*—The pupils of all four patients were dilated widely, even before an increase in leukocytes appeared and some time before actual symptoms of rabies began to manifest themselves.

*Headache and vertigo.*—These symptoms were among the first complained of by all of the patients.

*Numbness and formication.*—Numbness of the arm on the same side as the fingers receiving the bite was noted in three of the cases, and one patient complained of tingling in the affected arm and dizziness when he would lie on his side and get up suddenly.

*Spasms of the throat and chest muscles.*—Occurred early in all of the cases and seemed to usher in the acute stage, becoming progressively worse until complete paralysis and death occurred.

*Frothing at the mouth.*—This was present in all four cases as soon as the throat spasms became severe enough to prevent swallowing. Evidently due to the inability to take care of the normal saliva. The excess saliva incorporated with the air and secreted on account of the constant movement of the muscles of the jaw and neck caused the frothing to occur.

*Respiratory paralysis.*—All of the patients had exactly the same type of breathing once the actual attacks of spasm began. It seemed difficult to inspire air, so much so that it was necessary for them to place the hands behind the neck in order to throw the ribs and chest muscles forward and thus expand the lungs. It was easy for them to exhale air simply by dropping the chest and allowing its weight to force the air out of the lungs. This caused a characteristic gasp with throwing up of the entire chest each time they took a breath.

*Fear of water.*—Never was a disease more aptly designated than this one when it was given the name of hydrophobia. These patients had no particular fear of liquids, but it was fear of water per se. When the disease had progressed to an acute stage in each case, the mere mention of the word "water" would send them into a spasm, and in one patient would cause him to become maniacal, even to the point of trying to knock the glass out of an attendant's hands with his head whenever a glass of water was shown him.

One patient stated that he first noticed his difficulty in swallowing when he heard water running in the bathroom. Another stated that he cupped water up in his hands to wash his face and that the "smell" of it nauseated him and caused him to vomit. The other two discovered that they could not swallow when they attempted to take a drink of water the first thing in the morning.

*Leukocyte counts.*—A progressive increase in the number of leukocytes was present before actual symptoms began in each case, with a definite decrease in lymphocytes, more marked than the increase in neutrophils.

*Temperature.*—In three cases it was not sufficient to indicate the seriousness of the disease even just before death. The fourth just before death ran a temperature of 108.2° F.

*Skin hyperesthesia.*—This was present in all four cases, and they seemed uncomfortable with even a light sheet over their bodies. The first case complained of pain whenever the air blew on his body.

*Negri bodies.*—These bodies were demonstrated in all four cases, fresh smears of brain tissue being stained by the Williams-Lowden technic (1).

*Types of cases.*—Two of the cases were of the quiet, mild type, usually known as "dumb" rabies. The other two were of the violent, maniacal type, and required restraint when the disease became severe.

*Morbidity and mortality rate.*—Of the eight men bitten by the same animal, four died, giving a morbidity rate of 50 per cent, and a mortality rate of 100 per cent of those contracting the disease.

#### TREATMENT

Osler (2) states that "when once established the disease is hopelessly incurable." Therefore the treatment should be started immediately after receipt of the bite. Treatment is primarily prevention.

*Local treatment.*—Early and efficient cauterization of all dog-bite wounds should be made, even to the extent of administering a general anesthetic and using surgical technic to open the wound wide. This is especially important in wounds about the face and head. Fuming nitric acid is the best cauterizing agent, and if not available actual cautery may be used.

We would like to emphasize the point that tincture of iodine, mercurochrome, and various other local antiseptics are probably worthless for the prevention of rabies.

All four of our cases that died had very small lacerations, and the scars were insignificant when seen just before the disease began to develop.

*General treatment.*—According to Tice (3) "The development of rabies in man can be prevented by prompt inoculation in over 95 per cent of cases bitten."

Since it may result fatally to take chances, antirabic treatment should be given at once in all doubtful cases.

We have had no serious reactions in 30 cases given immunization with the antirabic vaccine furnished by the bureau of science in Manila. Two of the persons treated had a slight fever four or five hours after the injections. If given in the back muscles with a fine needle, the injections are practically painless and the element of hysteria is avoided.

In theory the dog should be captured and kept under observation for 10 days, but this is often impossible, particularly in foreign ports, and especially in the Orient, where stray dogs are numerous and the authorities apparently have little or no control over the animals. This is especially true in China and in the Philippines. It has been estimated that there are 20,000 stray dogs in Manila alone.

Magnesium sulphate was given intramuscularly to the fourth case at the suggestion of Doctor Schöbl, of the bureau of science in Manila, and Major Holt, of the Army medical research board in Manila, who kindly offered their services and advice.

They have found that intramuscular injections of magnesium sulphate in these cases controls the spasms better than any other remedy. They mentioned the fact that the type of rabies seen in this part of the world is extremely virulent, one of the cases under their observation contracting the disease after having received 14 injections of antirabic treatment. Another case, that of a small child bitten on the face, developed the disease and died in eight days. Bites on the face are more rapidly fatal, and in this case the child died before the dog did.

#### SUMMARY AND CONCLUSIONS

1. Four deaths are reported from among eight persons bitten on the hands by the same rabid animal.
2. The disease was aptly named, originally, when it was called hydrophobia, for in all of these cases it was not the fear of liquids that was manifested but absolute fear of water. One patient stated that he could not even stand the "smell" of water.
3. Two very characteristic early signs in these cases were vertigo, dilatation of pupils, and numbness either of the side on which the bite occurred or of the whole body. This numbness later changed to a hyperesthesia of the skin all over the body.
4. It is believed to be a good treatment to dissect out the scars where the bite occurred, if the case is seen long after the bite. The

four patients who failed to contract the disease were taken to the operating room and all scars and surrounding tissue dissected out as soon as the fourth case began to develop. It is believed that the virus develops at the site of the original portal of entry into the body, and that it is gradually disseminated into the system from that point. This treatment is in addition to cautery with nitric acid at time of the bite and administration of antirabic treatment.

5. It is believed that an effort should be made to develop a shorter course of treatment, if it can be made as efficacious as the present method.

6. The need of a short course of treatment is evidenced by the remaining four persons who were bitten. After the death of the fourth case, three of those remaining began to run leukocyte counts from 12,000 to 15,000, which persisted for a few days, but they had already received nearly half of the course of 25 injections, and it is believed that they established their immunity to the infection just in time to prevent them from contracting the disease.

7. Negri bodies were demonstrated in fresh preparations from the brains in all four cases.

8. Two patients were treated with immune serum, one intraspinally and intravenously, the other by intravenous injection alone. Its action on the first patient treated with it was suggestive of some type of immune reaction, and it is believed that more experimental work should be done toward production of a treatment serum.

9. The incubation time of the four fatal cases was approximately 29, 30, 32, and 34 days, respectively.

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- (2) Osler and McCrae, *Principles and Practice of Medicine*, Ed. 11, 1930, p. 357.
- (3) Tice, *Practice of Medicine*, vol. III, 1927, p. 545.

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#### THE CLINICO-PATHOLOGICAL ASPECT OF THE PITUITARY GLAND<sup>1</sup>

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The clinical, physiological, and pathological study of the endocrine system as we understand it to-day may be termed of recent origin. It is quite true that the organs were known to investigators of early

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<sup>1</sup> Read before the medical staff of the United States naval hospital, Newport, R. I., Oct. 20, 1931.

times; for instance, Vesal in 1553 described the pituitary gland, whose function was excretory, that is, an organ which eliminated mucous (pituita) from the brain by way of the nose.

Pursuant to the ever-increasing intensive study of the ductless glands carried on in the laboratory and in the clinic, an enormous amount of literature has sprung up during the past several years. A proper evaluation of the same is no easy task. It is infinitely more difficult to present a paper before a medical group whose constituent members cover a variety of intensive specialties, so that it may serve a practical purpose in being helpful at the bedside, in the office, and in the laboratory.

#### ANATOMY OF THE PITUITARY GLAND

The hypophysis (pituitary body) is a neuroglandular organ, its glandular portion being of the ductless, endocrine, or internal secretion type. It is a small reddish-gray body, resting in the hypophyseal fossa. In man it measures about 12 millimeters in the transverse, 7 millimeters in the sagittal, and 5 millimeters in vertical diameter. (Gray.)

The gland consists of an anterior and a posterior lobe, which differ from one another in their mode of development and in structure. The anterior lobe, the larger, is somewhat kidney shaped, the concavity being directed backward and embracing the posterior lobe. A number of authors state that it consists of a pars anterior and a pars intermedia, separated from each other by a narrow cleft, the remnant of a pouch or diverticulum. More will be said a little later about this part. The pars anterior is extremely vascular and consists of epithelial cells of varying size and shape, arranged in cord-like trabeculae or alveoli and separated by large, thin-walled blood vessels.

The pars intermedia, as described by some, is a thin lamina closely applied to the body and neck of the posterior lobe and extending onto the neighboring parts of the brain; it contains few blood vessels and consists of finely granular cells, between which are small masses of colloid material. The pars intermedia, in spite of the fact that it arises in common with the pars anterior from the ectoderm of the primitive buccal cavity, is often considered a part of the posterior lobe which arises from the floor of the third ventricle of the brain.

Although of nerve-tissue origin, the posterior lobe contains no nerve cells or fibers. It consists of neuroglia cells and fibers and is invaded by columns which grow into it from the pars intermedia, while embedded in it are large quantities of colloid substance histologically similar to that found in the thyroid gland. In certain of



the lower vertebrates, e. g., fishes, nervous structures are present and the lobe is of large size.

#### HORMONES ISOLATED FROM POSTERIOR LOBE

The posterior lobe of the pituitary gland, which really is a further development of the gray matter of the floor of the third ventricle, has finally yielded some of its secrets to the indefatigable labors of the scientist serving in the laboratory. These secrets consist in the isolation of some of the hormones that are propagated by the cellular structure of this said lobe. This is a definite advance in our exact knowledge of the physiology of this organ. These hormones have been isolated in crystalline form and have been demonstrated to induce definite physiological function.

The methods used in isolating the hormones are now pretty well known, therefore it might be well to leave a description of the purely mechanical nature to another time.

Among the hormones that have thus far been isolated from the posterior lobe, are those which have oxytocic action, that is, a principle which causes contraction of the uterus; pressor action, that is, a principle which raises blood pressure; diuretic-antidiuretic action, that is, a principle which influences diuretic-antidiuretic process.

Many countless experiments have been carried out to establish the action of the various principles obtained from this part of the pituitary gland. In order that we may have a more plastic conception of this complex subject, we might give some of the commonest experiments. This will reduce the matter to the simplest terms.

Dogs are deeply anesthetized with chloretone and then the carotid arteries are connected to mercury manometers by cannulas. Pituitrin (vasopressin) is injected into the saphenous vein and an immediate rise in blood pressure is observed on smoked paper, which is a part of the apparatus used to graphically record the changes that take place.

The oxytocic action of the pituitary preparation (oxytocin) is easily ascertained by attaching a strip of uterine muscle from a guinea pig, which strip has been immersed in a solution of pituitrin, to a writing lever in such a way that its contractions are recorded on smoked paper of the kymograph.

It is well known that pituitary solution has a diuretic-antidiuretic action. By experiments on rabbits it has been determined that it is the pressor principle that has this activity. In making the tests rabbits were used under urethane, amytal, chloretone, or chloralhydrate anesthesia. Cannulas were tied into the urinary bladders and then the number of drops of urine excreted in each 5-minute interval was counted.

When 0.2 standardized unit of pituitrin was injected, during an experiment, there was first a short latent period or possibly a short period of suppression of urine, followed by an increased excretion of urine amounting to 21 drops in 5 minutes. Then followed the antidiuretic effect, so that in 40 minutes only 3 drops of urine were excreted.

When 0.2 unit of vasopressin was injected there was a flow of urine amounting to 25 drops in 5 minutes. This was followed by the antidiuretic effect. No urine was excreted in two 5-minute periods. The antidiuretic effect was subsiding when 0.2 unit of oxytocic was injected. This was followed by slight increase of flow of urine, which may have been due to a small amount of vasopressin in the solution—about 0.01 unit.

The injection of 0.2 unit of pituitrin caused a gush of urine, which reached the rate of 38 drops in 5 minutes and lasted for 20 minutes. The antidiuretic effect was not apparent after this injection.

The injection of 0.2 unit of oxytocin produced very little effect.

The injection of 0.2 unit of vasopressin on the other hand caused diuresis amounting to 29 drops in 5 minutes. This diuresis subsided, so that in the course of 35 minutes the antidiuresis began to be apparent.

An injection of 0.2 unit of pituitrin caused a gush of urine, 28 drops being excreted in 5 minutes. The antidiuretic effect appeared in 25 minutes. (Bugbee and Kamm.)

Another very interesting pharmacological action of hypophyseal extract (pituitrin) is the darkening of the skin of frogs and tadpoles. When a frog is exposed to bright sunlight, it becomes very much lighter in color. Then if the frog is injected with pituitrin it turns almost black within a few minutes. L. W. Rowe has demonstrated that vasopressin produces the color change, while oxytocin has very little effect.

A few facts may demonstrate the extreme difficulties encountered in the attempt to isolate the active principles of the pituitary. Two hundred beef pituitaries weigh only about 550 grams; of these, the posterior lobes weigh 50 grams. When desiccated the posterior lobes weigh only 8 grams. The purified pressor fraction weighs only 0.050 gram and the oxytocic fraction weighs only 0.015 gram. It is with these almost infinitesimal fractions that the experiments have to be conducted.

Let us summarize the foregoing.

Thus far, the posterior lobe of the pituitary gland has yielded two active principles—an oxytocic principle, which causes contraction of the uterus, and a pressor principle, which raises blood pressure.

These two active principles have been separated and obtained in the form of white, stable, water-soluble powders of great potency.

Solutions of these separated active principles have been recombined to form a pituitary extract identical with the original from which they were prepared, thus proving that no decomposition had taken place during the process of separation.

The oxytocic principle, which has been named alpha-hypophamine, causes contraction of uterine muscle when applied by contact. It is nearly free from action on other forms of smooth muscle.

The pressor principle, named beta-hypophamine, does not affect uterine muscle, but stimulates peristalsis in the gastro-intestinal tract. It has both a diuretic and antidiuretic effect. It causes expansion of the melanophores in the skin of frogs.

Thus we have some definite information respecting the physiological functions of the posterior lobe of the pituitary gland. The isolation of some of its active principles is a long stride in the realm of exact knowledge. Having taken a small excursion into the charted vistas of the posterior lobe, we will now pass to a discussion of the anterior lobe of the hypophyseal gland.

#### ANTERIOR LOBE—CELL STRUCTURE

The anterior lobe is derived from the ectoderm of the stomodeum. About the fourth week there appears a pouchlike diverticulum (pouch of Rathke), which is the rudiment of the anterior lobe. It extends upward in front of the cephalic end of the notochord and the remnant of the buccopharyngeal membrane and comes into contact with the undersurface of the fore-brain, is then constricted off to form a closed vesicle, and remains for a time connected to the ectoderm of the stomodeum by a solid cord of cells. Masses of epithelial cells form on either side and in the front wall of the vesicle, and there is growth between these of a stroma from the mesoderm. The upwardly directed hypophyseal involution becomes applied to the anterolateral aspect of a downwardly directed diverticulum from the base of the fore-brain, which constitutes the future infundibulum in the floor of the third ventricle, while its inferior extremity becomes modified to form the posterior lobe of the hypophysis. In some of the lower animals the posterior lobe contains nerve cells and nerve fibers, but in men and the higher vertebrates these are largely replaced by connective tissue.

A craniopharyngeal canal is sometimes found extending from the anterior part of the fossa hypophyseos of the sphenoid bone to the under surface of the skull, and marks the original position of Rathke's pouch, while at the junction of the septum of the nose with

the palate traces of the stomodeal and are occasionally present (Frazer quoted from Gray).

*Histology.*—The anterior lobe, histologically, may be divided into cells which stain well and cells which do not; those which do take the stain well being called chromophile cells, and those which do not being termed chromophobe cells. The chromophile cells are further subdivided into cells which take an acid stain and are known as eosinophile cells, and those which take a basic stain and are known as basophile cells. The eosinophile cells are spheroid or polyhedral in shape, with a nearly homogenous protoplasm full of fine granules that stain strongly with eosin. The nuclei are small and rounded, stain strongly with hematoxylin, and are placed in the center of the cell. The basophile cells are also large, with well-defined borders, and stain a dark blue with hematoxylin; the protoplasm contains coarse granules, and the nuclei are concentrically placed and frequently contain vacuoles. The second main variety of these cells are the chromophobes, which present ill-defined borders and have protoplasm that does not fix or stain well; their nuclei, however, are large, either round or irregular in shape, and possess a network which stains deeply with the nuclear stains. During pregnancy the chromophobe cells undergo some changes. Their nuclei appear large, light, and irregular; plasma becomes more abundant and distinctly granular; the granules take the eosin stain well. Erdheim and Stumme termed these "pregnancy cells." Another cell type found in the gland, particularly about the stalk, is the squamous.

The finely-balanced play of all these cellular elements makes up the normal physiologic function of the anterior lobe of the hypophyseal body. On the other hand, any one of the histologic cellular elements may undergo hyperplastic development and produce a tumor with clinical characteristics of the particular cell of which it is composed. Thus, it is quite possible to have an eosinophile cell tumor, a basophile cell tumor, a principle cell tumor, a pregnancy cell tumor, or a squamous cell tumor. Each one of these particular cell type tumors is in reality an hypophyseal tissue tumor, but with this distinction—it is not a total, but rather a partial pituitary tissue tumor. It appears that the tumor formed of any one of these particular cell types is capable of producing a characteristic effect upon the human economy. Thus, the clinical picture in consequence of an eosinophile cell tumor is entirely different from the picture resulting from the influences of a squamous cell, or a principle cell, or even a basophile cell tumor. It is very important that this distinction be held in mind, and it will be again stressed as pathology of the gland is considered.

## SOME BASOPHILIC CELL ADENOMAS

Harvey Cushing, in an address given January 5, 1932, at the Neurological Section of the New York Academy of Medicine, called attention to a most interesting series of pituitary cases which he attributed due to basophilic cell adenoma. He presented a number of photographs which were obtained either from the authors who had reported the cases or were copied from the literature. Microscopic sections showing unmistakable evidences of basophile cells were thrown upon the screen. These sections were obtained directly from the authors of the cases.

While Cushing speculatively attributed the clinical phenomena presented by the various patients before their deaths to an adenoma of basophilic cells, there is still a great deal of controversy as to whether these cases are of a pluri-glandular disturbance or whether the syndrome complex can be attributed to the basophile cell adenoma as a primary cause of the clinical phenomena. There have been only a very few cases reported thus far and only a very small percentage of the cases underwent a post-mortem examination. Some of those that were examined in the laboratory showed only a tumor of the suprarenal gland and apparently did not show evidences of pituitary affection. Whether the pituitary had undergone a proper pathological examination is very hard to determine from the reports. However, in cases like Teel's, Kraus', and Parkes', definite basophilic adenomas are shown. Clinically the Röntgenographs did not disclose an enlarged sella turcica. At post mortems the pituitary did not show any particular increase in size nor any gross pathological changes. Only after Teel cut and stained the gland, did the examination reveal a small adenoma consisting of basophile cells. It might be concluded from the evidence at hand, that the adenoma is of very small size and does not appreciably increase the size of the gland.

Some of the clinical phenomena presented by these patients are as follows:

This disease appears to affect people of the adolescent age. These may be short of stature but the majority of those reported give the appearance of gigantism. They have long, comparatively thin legs and an enormously enlarged upper body. The head, neck, and upper torso are enlarged and covered with layers of fat. The neck and head, at first appearance, give the impression to the onlooker of belonging to a heavy-weight wrestler. They have stooped, rounded shoulders, a markedly enlarged, pendulous, and adipose abdomen and marked stria about the abdomen and hips. There is considerable hypetrichosis about the body. The female who ordinarily has a very smooth face, in the final stages acquires coarse

hair about the face and chin, as well as other parts of the body. The secondary sexual characteristics become exaggerated, breasts large and pendulous. They suffer from amenorrhea. Eyes frequently protrude, lids puffy and face cyanosed. They become gradually weaker and at all times are subject to violent intermittent headaches. It is usually the headaches which bring them to the physician's office. The blood picture shows increased erythrocytes. Blood pressure is markedly increased. They frequently suffer from diabetes, subcutaneous hemorrhages and are easily bruised. The optic disk shows only a haziness about the borders.

Teel's case had some of the above characteristics developed in an unusual degree, which might be worth mentioning at this time. His case published in the Archives of Neurology and Psychiatry, September, 1931, volume 26, pages 593-599, was that of a white woman, age 20, weighing 178 pounds on admission to the hospital, although seven months previous, she had weighed 206 pounds.

Her face was covered with a heavy black beard, which had obviously been subjected to constant shaving for some time. The thorax, abdomen, and extremities were covered with coarse black hair. The immediate cause of death was meningococcic leptomeningitis.

Necropsy performed on the day of the patient's death revealed that the ovaries, thyroid, and suprarenal cortex were decidedly hypertrophied, the thymus uninvoluted and the islet tissue in the pancreas possibly hypertrophied, the only truly neoplastic growth was a small basophilic hypophyseal adenoma.

*Hypophysis.*—Grossly, the hypophysis appeared normal in size and shape. There appeared to be the usual relation between the types of cells comprising the glandular portion, but at the lateral inferior margin of the pars anterior there was a sharply circumscribed nodular collection of basophilic cells. The structure of this nodule differed from normal structure in that all of its cells were basophilic. They were arranged in cords with the usual amount of stroma. Although the nodule did not appear to be encapsulated, there was evidence of compression atrophy of the surrounding glandular tissue.

This condition has been observed more in females than in males. Why this is so, is as yet unknown. These cases last about five years from the time of the onset of the symptoms until death.

X-ray treatment was reported by Cushing to have arrested the progress of the disease in one case. Another case showed apparently spontaneous arrest of symptoms, without treatment.

#### ACROMEGALY

Minkowski, Marie, Broca, and others, in their post-mortem studies of acromegalic patients, found a large tumor in the sella turcica and changes in the acral parts, which were frequently very much enlarged, but often very marked changes in other parts of the body, particularly in those organs which go to make up the endocrine system.

Minkowski vouchsafed an opinion that tumors of the hypophyseal gland were, in all probability, responsible for acromegalic changes.

Marie, however, seemed to waver in his deductions, in spite of the fact that it was he who first issued the remarkable studies which added so greatly to our store of knowledge of this affliction. He could not quite bring himself to the point where he could accept as fact that tumors of the hypophysis were the primary cause of the evident clinical changes observed in acromegalics, because certain definite criteria were absent. There were not always present the same changes which define this disease. While clinical syndromes and histopathologic findings may vary to a limited extent in a given disease, the range of variation can not well extend beyond a certain maximum and still be considered as part of the disease entity. There were reports of clinical acromegaly which did not disclose changes in the sella turcica nor present a tumor there. There existed considerable hesitancy in accepting the tumor idea of the hypophyseal gland as being the etiologic factor of this ailment. As a matter of fact, normal pituitary glandular tissue and no disturbances in the Turkish saddle were found in a patient who, clinically, presented a great many of the symptoms generally accepted as constituting the acromegalic syndrome. There was considerable hesitancy and wavering among the medical investigators as to just how to put all of the recorded facts together. Suddenly a new light was shed upon the controversy.

*Eosinophile cells responsible for acromegaly.*—About 1905 a shoemaker, aged 43 years, came from Bohemia to the ear clinic in Vienna, suffering from a chronic otitis. The history disclosed a chronic otitis media of many years' standing, with evidences of an intracranial complication. The examining physician observed that in addition to the ear and possible cerebral disturbances, the patient presented enlarged hands, feet, nose, and chin, and thickened lips and tongue. The signs were unmistakably acromegalic. The doctor's inquisitiveness being aroused, he further asked the patient whether he had always had such enlarged acral parts. The reply was in the negative. The patient did, however, observe that these particular parts began a new and second growth approximately 12 to 15 years previously, and continued to grow until his admission to the hospital. The neurologist and internist called into consultation confirmed the probable diagnosis of acromegaly. A few days later the patient died of cerebral meningitis of otitic origin, not having been treated surgically.

The post-mortem, which was done by Ghon, and studies afterward made by Erdheim, disclosed the usual meningeal pathology as being the direct cause of death. Nothing was found in the sella turcica to account for the acral enlargements. The pituitary gland was normal, macroscopically and microscopically. If ever there existed a good and sufficient reason to doubt relationship between the hypo-

physeal gland dysfunction and acromegaly, here was surely an illustration par excellence, but, while subjecting the anatomic parts to an unusually close scrutiny, Erdheim came upon a large foreign mass within the central part of the sphenoid bone, a mass which filled practically the entire sphenoidal sinus, pushing upward until there was an erosion of the floor of the sella. Histologic examination of the tumor mass proved it to be an hypophyseal glandular tissue tumor. This growth was composed of eosinophile cells, and as this is but one of the numerous cell types which go to make up the anterior lobe this tumor was a partial and not a total anterior lobe tumor. It is important that this differential fact be kept in mind, for it is only because of this fact that certain deductions can be made relative to particular groups of clinical symptoms.

The whole observation is quite absorbing, with no little interest being attached to the question: How did the tumor, being of pituitary glandular tissue, get into just that particular location; how did it get into the body of the sphenoid bone? After this question is answered, some comment anent certain clinical symptoms, which have become very closely allied to disease of the pituitary gland, should also be given consideration.

In order to intelligently answer the question of how the tumor got into the sphenoid bone, it is necessary to look back to its origin and then follow it to its final anatomic resting place.

#### ORIGIN OF SOME PITUITARY TUMORS

At the outset of this paper it was pointed out that the anterior lobe is developed by protrusion of an ectodermal pouch from the roof of the pharynx. This embryonic organ passes upward through the embryonic opening, which afterwards becomes known as the craniopharyngeal canal, formed in what at a later period becomes the sphenoid bone. In the entire passage, from the pharyngeal roof to the sella turcica, the anterior lobe leaves "rests."

Killian, in 1888, made note of a pharyngeal hypophysis. Civaleri, at an anatomic congress held at Marseille in 1908, under the title of "L'hypophyse pharyngienne chez l'homme," called attention to the pharyngeal hypophysis. Haberfeld, May 4, 1909, Vienna, reported an exhaustive study of the pharyngeal hypophysis. His conclusions were summed up as follows: That in the roof of the pharynx there was hypophyseal tissue. That it was a constant organ of the human body. That it was found in the fetus, in the new born, and persisted up to old age. In addition, he found germinal hypophyseal cells between the pituitary tissue and the bony part of the cranium; within the canalis craniopharyngeus; in the uppermost end of the canal; further, between the bony sella turcica and the hypophyseal gland; and still further, in the cranial vault attached



to the hypophyseal stalk. In the case of an anencephalus he found that the entire canalis craniopharyngeus, which remained persistent up to the intrasellar pituitary gland, was literally sowed with hypophyseal tissue germinal cells. Many authors state that up to 10 per cent of all new borns show a persistent craniopharyngeal canal.

These germinal cells or hypophyseal rests, as Erdheim calls them, extending from the roof of the pharynx to the suprasellar stalk, can undergo a hyperplastic development. When an hyperplastic growth does occur and the mass consists of eosinophile cells an overgrowth of body tissue takes place. The secretion given off by these cells is, in all probability, poured directly into the blood stream.

The early observation that only a hypophyseal gland tumor situated in the sella turcica can produce acromegaly, does not stand to-day as entirely correct. Erdheim's findings in the case where the tumor was located in the sphenoid bone point to the possibility that in acromegalics, where no hypertrophy of the intrasellar hypophyseal gland could be found, there may yet have been hypophyseal cell tumor somewhere else. Attention is directed to the fact that in this particular case, as well as in some subsequent cases to follow, the growth was not composed of all the cellular elements of which the normal gland is formed, but rather built up of a single cell element. If other cell elements were present, the quantity was insignificant as compared to the numbers found in the normal tissue. Therefore, while acromegaly is, in truth, a hyperpituitarism, it is not a hyperpituitarism totalis, but rather a hyperpituitarism partialis.

One of the most difficult tasks with which investigators have been confronted during studies of acromegaly and the hypophyseal-gland tumor has been to recognize which part of the clinical picture belonged to direct action of the tumor, and which part to disturbance of normal function of neighboring parts. The usual seat of pituitary growths is in or about the sella turcica and they are usually adenomas. Growths in other parts, for instance in the sphenoidal bone body, are rare. Clinical syndromes produced directly by a pituitary cell tumor and those produced by a lesion of the cerebral base were so intermingled and interrelated that problems of the most difficult nature had to be faced when attempts were made to differentiate between those hypophyseal and those of cerebral origin.

#### GIGANTISM—TYPUS MARIE AND TYPUS LAUNOIS

In the case of the shoemaker, we are offered a study of a tumor, inclosed within a bony capsule, far removed from vital organs. Whatever abnormalities occurred must be attributed to this tumor. The acromegalic changes that were observed, both clinically and

pathologically, must be attributed to the collection of eosinophile cells. One is justified, at least in this case, in assuming that acromegaly is a direct result of an increased secretion of eosinophile cells, which are a constituent part of the normal hypophyseal glandular tissue. Since the eosinophile cells are only a part of the glandular structure, it must be said, then, that acromegaly is the result of a hyperpituitarism partialis. Eosinophile cells appear to have a direct influence upon tissue growth. When an increase of these cells occurs, with a consequent increase of secretion taking place after ossification of the epiphysis is completed, acromegalic changes result. If, however, the disease begins before ossification of the epiphysis is completed, gigantism of the Launois type results. In the first class, which sometimes is called the "typus Marie," if the disease begins after normal growth of body has ceased and the epiphyses are closed (after the second decennium), then important skeletal and tissue changes occur, but without the height increase in size of the individual. In the second instance, the "typus Launois," the disease occurring before the epiphyses are closed, height increase in size of the individual occurs—Cushing reported a case of a 15-year-old male, who attained a height of 8 feet 3 inches and a weight of 275 pounds—with terminal stages of enlargement of facies, hands, and feet. Another very interesting case which bears out the foregoing statements is reported by Louis H. Behrens, of a boy, 12 years old who weighed 247 pounds and was 6 feet 10 inches tall. Frequently these cases wind up with much adiposity. The writer saw a 25-year-old male more than 8 feet tall, recently, exhibiting unmistakable evidences of acromegaly.

It has already been mentioned that Haberfeld and Erdheim noted that hypophyseal tissue rests or hypophyseal germinal cells may be lodged in the sella itself, separate and distinct from the normal gland. These rests may undergo hyperplastic changes. If these growths be composed of eosinophile cells, acromegalic enlargements or gigantism can be the consequence. These tumors are mostly adenomas, of very slow growth usually, and the disease may stretch into many years, 30, 40, or even 50 years, before the patient finally succumbs. It is because of this chronicity that complete clinical and pathologic studies have been rare; the patients seeking relief from their varied ailments, especially the terrific, persistent headaches, going from doctor to doctor, from clinic to clinic, and no clinic or doctor having them long enough under observation to make a complete study of data.

Tumors which have their origin in the hypophyseal rests in the sella continue to develop, and as they grow encroach upon the normal gland, and interfere with its function. The foreign mass, as it expands, presses upon the normal gland, bringing about an atrophy

of its acini, with consequent lowered normal secretion, a condition of hypopituitarism totalis.

Benda was one of the first to call attention to the eosinophile as being the cell which possibly secretes the hormone that excites the overgrowth observed in acromegaly and gigantism, and subsequent studies have gone far to support his view.

In the wake of these statements, another pertinent query presents itself; namely, are hypophyseal rests always eosinophile cells? Not at all. The rests may consist of any of the other cells and when rests consisting of squamous cells, basophile cells, or even pregnancy cells, develop into large masses, they, too, cause no little amount of inconvenience, apparently not so much because of the secretion they pour into the blood stream but rather because of the accident of location. So far as we know the cells that produce internal secretion are the eosinophile, basophile, and perhaps pregnancy cells. We will again refer to the basophile as well as the pregnancy cells a little later.

#### MECHANICAL INTERFERENCE WITH NORMAL ANTERIOR LOBE DEVELOPMENT

One of the principal clinical manifestations due to a decreased pituitary gland function, when occurring in a growing individual, is interference with development of practically all of the other organs. If interference with the glandular function is very marked, there occurs almost an entire cessation of growth. It is perhaps not essential that the disturbing factor be a tumor of hypophyseal tissue; apparently any other interference with its function will exert the same effect. It is interference with normal function of the gland, so that there occurs a hypofunction, or a decreased secretion of hormone, which is at the bottom of the trouble. The writer, not long ago, saw a male 23 years old whose size and measurement were practically those of a child 8 years of age. The history disclosed the fact that when about 7 or 8 years old, the patient suffered an accidental revolver shot wound, the bullet entering the temple, X rays, even at this late date, showed evidence of a foreign body located in the region of the hypophyseal gland. The foreign substance, which evidently was part of the exploded bullet, interfered with normal secretion of the pituitary gland to the point of having brought the growth of the individual to almost a standstill. This, apparently, is unquestioned evidence that bodies other than tumors, when pressing upon the normal hypophyseal gland will disturb and lower its function. Another important clinical feature gleaned from this case is the fact that interference with normal processes of the hypophyseal gland, in a growing individual, so that a "hypopituitarism totalis" is the immediate result, will cause material interference with skeletal growth as well as sexual development. The interference with bodily

growth may be partial or may be total, depending upon the degree of hindrance forced upon the normal gland and how badly the discharge of its normal functions are blocked. The epiphyses in these cases remain open long after the date when normally they should be closed, the genitals remain infantile, secondary sexual organs are undeveloped with sacral and pubic hypotrichosis, etc.

#### PALTAUF DWARF

Arnold Paltauf was the first to make an exhaustive study of a male who at the time of death was close to middle age, and who had supposedly been suffering from a pituitary gland disturbance. This individual made his living as a member of various side shows, and otherwise presenting himself where Lilliputians performed. His intelligence was always good. For years his was a familiar face in the side shows on "The Prater" in Vienna, but he evidenced a slow but continued growth and several years before death became too large to serve as an attractive Lilliputian and was, therefore, discharged; he had, however, never attained a growth sufficient to be normal. His sexual organs remained immature, with hypotrichosis, no hair about his chin, and voice that was childish. Post-mortem disclosed a deepened and widened sella filled with a mass which did not look like pituitary gland tissue. Paltauf did not express his opinion as to the etiology of this mass, but said that the tumor, which had occurred early in life, had pressed upon the normal hypophyseal gland and interfered with function. The secretion, however, was apparently not only sufficient to sustain life but to influence a slight degree of growth. The epiphyses having remained open, growth continued long after the usual time. This man, known as the Paltauf dwarf, is accepted as the classical representation of the *Nanosoma pituitaria infantilis*. Erdheim states definitely that the etiology of the Paltauf dwarf can be ascribed to a tumor developed from an embryonic rest which the anterior lobe deposited within the sella at the time of its own nesting there. This rest consisted of some cell type other than the eosinophilic. Erdheim based his supposition upon three of his well-studied cases: In one he had found an hypophyseal passage tumor which almost completely destroyed the true hypophyseal glandular tissue; the other two were basophile cell tumors. In the Paltauf dwarf we are faced with a condition in which the true hypophyseal glandular tissue suffered an interference with its normal play of function in the early years of life, the secretion being insufficient for normal bodily needs, growth, and development suffered marked retardation.

## HYPOPHYSEAL DWARFS

Jutaka Kon reported a 27-year-old male, 127 centimeters in height, with no hair in the axillary or genital regions. Intelligence was normal. An infundibular tumor, which he called a teratoma, was found at post-mortem examination. This tumor compressed the hypophyseal gland markedly. The testicles corresponded in size to those of a 3-year-old child; penis was very small; thyroid gland hypoplastic. Erdheim does not accept this as a teratoma, but calls it rather a hypophyseal passage tumor (hypophysengang tumor). Sternberg's comment on the testicles may be summed up as follows: In cases of hypopituitary dwarfs the testicles may remain infantile, i. e., they do not undergo any development at all or may, in case some development had taken place, undergo an atrophy.

Narazi reported a 20-year-old individual, 125 centimeters in height, who had good intelligence. In the first years of his life development seems to have been quite normal; then, about the sixth or seventh year, there was cessation of further growth. Post-mortem disclosed tuberculous meningitis and chronic miliary tuberculosis of the lungs; in addition, a large cyst of the hypophyseal gland substance could be observed, and also hypoplasia of the thyroid gland and the testicles. In this case the histologic appearance of the testes would suggest more a hypoplasia than an atrophy.

Simmonds' reports on a 21-year old man: 110 centimeters high and proportionately built dwarf; good intelligence; open epiphyses; beard, axillary and pubic hair entirely missing; external genitalia corresponding to that of an infant; testicles the size of a pea, weighing 0.9 and 1.2 grams; thymus gland weighed 2.5 grams; adrenals particularly small; thyroid weighed 2 grams. A very interesting feature of this case is the fact that histologically the thymus gland, adrenals, pancreas, liver, and spleen were all normal. The hypophyseal gland was very small, weighing only 0.2 grams. Macroscopically, there was no anterior lobe to be seen. The posterior lobe had the usual form and size. The posterior lobe was normal, but in front of it there were some smaller and some larger cysts. Of the anterior lobe there was only a small fragment to be found. The testicles showed hypoplastic structure. Simmonds considered the pathologic findings in this case to result from an embolic process suffered during the early days of life. According to Hoffmann-Kolisko the measurement bespeaks the size of a 6-year old child. We have got to assume that the disturbance which prevented normal functioning of the gland had already set in long before the person had reached the age of 6. At first, there was probably a gradual retardation of normal growth and then a practically complete ces-

sation. A strict analysis of the case would really place the glandular functional disruption at a very early age.

This patient, like all dwarfs coming to the attention of the writer, had persistent epiphyseal lines up to the time of death; ossification in the synchondrosis had not taken place. The case which Priesel described marks the one exception. Priesel particularly remarked that epiphyseal ossification was completed and he recognized this as a deviation from the usual.

*An unusual dwarf.*—The dwarf that Priesel described showed extraordinary features. He was born in Vienna, March 8, 1826, and died January, 1917, having apparently enjoyed good health up to the time he entered the old people's home. As a child he seemingly was normal in stature, but growth ceased at the age of 15 years; in reality he probably ceased growing at an earlier period, but at 15 he became aware that he was not growing any more.

He was accepted into the old people's home of Vienna, at the age of 60, where his intelligence earned him a position as chief of a part of the untrained male nursing department, which he held for over 10 years with satisfactory results to the management of the institution. His voice was squeaky and high pitched. In 1907 he suffered an attack of erysipelas of the right ear and head, which healed without giving any serious trouble. In June, 1916, he suffered a passing edema. In October, 1916, he had an attack of dyspnea and both legs became badly swollen. He then became permanently confined to his bed. Difficulty in urination set in very soon, but there was no history of polyuria. Weakness increased so that the patient slept almost continuously, and he died January, 1917.

A grand nephew of the patient, who was also at the home in 1917, stated that the mother died at the age of 81 years. The father's age at time of death was unknown. The dwarf had 3 brothers: 1 died at the age of 47; the second at the age of 52; the third at the age of 47 years. The father, mother, and brothers were normal in size.

At time of death the dwarf's stature was proportionate, gracile—musculature somewhat weak. Fat distribution—still enough to evidence that there had been a rich quantity present. The panniculus about the abdomen and mons veneris was quite generous in proportion. From either side of the mons veneris there were large folds, formed of fat and skin, drawing downward to the perineum and passing directly into the scrotum. The penis was 5 centimeters long. No testicles could be felt in the scrotum, but higher up in the folds of fat small bodies about the size of hazel nuts could be felt. The skull, a mesocephalic, was 51 centimeters in horizontal measurement and 3 to 7 millimeters in thickness. The brain was normal in configuration and weighed 1,050 grams. When the base of the brain

was cut, to be removed from the skull, it was seen that the hypophyseal stalk, at the place of insertion into the gland, was very thin, measuring only 0.5 millimeter. Toward the third ventricle the stalk became considerably thicker, measuring at its attachment with the brain 5 millimeters in thickness. The thyroid gland weighed 15.9 grams. The left lobe measured 4.5 by 2 by 2 centimeters; the right lobe 4 by 1.5 by 2 centimeters. The maximum thickness of the parenchyma was 14 millimeters; the isthmus was 12 millimeters long and 4 millimeters thick. Parathyroids: The right upper body measured 8 by 3 by 1 millimeters; the right lower, 3 by 1 by 1 millimeters; left upper, 14 by 10 by 4.5 millimeters. The left lower epithelial body was only a small mass of fatlike substance. The right adrenal, 4 by 2 by 0.6 millimeters, weighed 2.65 grams; the left adrenal, 4.5 by 1.7 by 0.5 millimeters, weighed 2.4 grams. The prostata, 2 by 3 centimeters, showed on cross-section areas of glandular tissue that could be recognized macroscopically. The vesiculæ seminales, 30 by 10 by 4 millimeters; cross section showed, macroscopically, no lumen. The testicles were found in the normal cavum vaginale, covered by a normal-appearing bluish white albuginea. The right measured 20 by 15 by 10 millimeters; the left 19 by 16 by 11 millimeters. On cross section a large quantity of connective tissue could be seen. A cross section of the penis about 2 centimeters from the sulcus coronarius glandis was 18 millimeters thick and 14 millimeters broad. The corpora cavernosa penis was 4 millimeters and the urethra 7 millimeters wide.

All other organs of the body were proportionate in parenchyma and connective tissue to the size of the body, except the hypophyseal gland, which was striking in its exception. That portion of the glandular tissue developed from the floor of the third ventricle—the neurohypophysis—was found suprasellar instead of within the saddle. The neural part of the gland was found behind the chiasm opticorum, attached closely to the infundibulum, hugging the base of the brain. On the anterior of the neurohypophysis just behind the chiasm was a platelet of orohypophyseal tissue, binding the suprasellar to the intersellar substance. The sella turcica was enlarged in all directions; wall thinner than normal. In the center of the diaphragm was a large opening through which the stalk passed. The stalk being very thin did not fill the entire opening, as result of which there existed a small communicating aperture between the sella and base of the brain. In the sella turcica was a thin tissue enclosing some fluid, débris, and a small quantity of glandular substance. Histologically, the glandular tissue consisted mainly of principle cells, although there were also some eosinophile and basophile cells. After removal of the soft parts, a small aper-

ture on the bony floor of the sella was exposed, where introduction of a sound led into a larger space within the sphenoid bone. The entire cleft leading from the sphenoid bone to the floor of the Turkish saddle was the remains of the embryologic canalis craniopharyngeus. Within the entire canal embryologic rests of the orohypophyseal tissue, in various stages of development and degeneration, could be seen. A good deal of the glandular tissue was also cystic. A small strand of pituitary substance passed between the sella and the sphenoid bone through the opening. There existed also a communication between the cyst in the sella and the cystic particles found in the body of the sphenoid bone. A persistent craniopharyngeal canal was found in this case. The neurohypophyseal body, not in its usual place, was normal in size and form. It was the anterior lobe of the gland that had undergone degeneration. The various changes observed clinically may be attributed to the loss of function of the anterior lobe.

In summing up the pathologic findings of this dwarf, the striking features particularly in evidence are: (1) Small size of the thyroid gland and the adrenals; (2) remarkable size of the epithelial bodies; (3) small genitals; (4) apparent early developed cerebral adipositas; (5) peculiarity of the glandula hypophysis; (6) persistence of the canalis craniopharyngeus; (7) remnants of the embryologic oroglandular cells within the canal; (8) embryologic development and degeneration. (Priesel.)

In the consideration of dwarfs it is very important not to confuse the various types. The etiology is not the same for all. The hypophyseal dwarf, the subject of our present thesis, is a proportionately built, gracile, and intelligent individual. He is the "Nanosomia" of Virchow, and is brought about by hypofunction of the hypophyseal gland. The disturbance occurs in early childhood. The condition also represents the *Nanosomia pituitaria infantilis* of Erdheim.

There are also the unproportionate dwarfs belonging to the rachitic, cretinitic, and chondrodystrophic family. These must not be confused with the hypophyseal midget, and since they are beside our present discussion, they must be dismissed from this paper.

#### NANOSOMIA PRIMORDIALIS AND NANOSOMIA INFANTILIS

Hanseman called attention to what he termed *Nanosomia primordialis*, which, according to Schwalbe, occurs through a "vitium primae formationis of the unfructified ovum." Hanseman, in addition is of the opinion that the condition can occur through a defect in the fructified ovum, or through a developmental defect in the embryo.



The *Nanosomia primordialis* is an individual that comes into the world already small; i. e., at birth it is smaller than the average, undergoes the usual normal development and growth, the epiphyses closing at the proper time, and cessation of growth takes place at the usual period. The genital organs undergo the average development with normal function, and the individual's physical size remains smaller than the average person. The *Nanosomia infantilis* are born normal in size, in fact it is seldom that one is smaller than the average at birth. At one period or another growth suddenly ceases. Although the epiphyses remain open, growth taking place to a very late date, the growth is so very slow that the individual always remains under size, as was noted in the Paltauf dwarf. In many instances, if growth does take place, it is practically imperceptible. The genital organs, either do not undergo development at all, or, if growth had taken place, atrophy sets in. The voice remains childish. The growth of hair on the chin, sacral region, armpits, is either entirely missing or is very sparse. The intelligence, while good, usually bespeaks that of a child 2 or 3 years above the corresponding size. Genuine dwarfs, if they are not at the same time microcephalics, are never idiotic.

#### DYSTROPHA ADIPOSEGENITALIS

When the anterior lobe reaches its seat, it sends a slight prolongation upward upon its stem or stalk and still further upon the infundibular process. This prolongation becomes slightly thickened. It is usually composed of the same cellular elements as the anterior lobe. Experience, however, informs us that squamous cells are the usual types found here. These cells undergo hyperplastic growth. If benign, the growth is invariably very slow and prolonged. It makes itself first felt in childhood. As it increases in size, it exerts pressure upon the hypophyseal gland proper, shutting off normal function. Interference with normal function of the gland is of a slow nature, because these tumors are themselves slow of growth. Although the tumors occur usually in childhood, the child undergoes its greatest growth before the tumor becomes large enough to markedly interfere with normal function of the hypophyseal gland which in turn interferes with further growth of the patient. These tumors have their origin in tissue above the sella, and are therefore termed suprasellar tumors. Individuals suffering from suprasellar tumors, while usually smaller than the average person in stature, are never so small as to be called a dwarf. Their sexual development is practically nil and if their genitals had undergone some development before the foreign mass had become large enough to press upon the pituitary gland with some degree of force, an atrophy sets in. Adiposity, an unequal and

singular distribution of fat, is also an accompanying symptom. The males assumes a more or less feminine type. This disease, known as dystrophia adiposogenitalis, was first described by Froehlich and is frequently referred to as Froehlich's disease. In addition to suffering from a hypogenitalism, adipositas, the individual also suffers from severe headaches, visual and trophic disturbances, and frequently from diabetes insipidus or perhaps mellitus. This suprasellar tumor causing these varied clinical symptoms is made up of squamous cells, developed from the squamous cells embryologically deposited by the anterior lobe about its stalk.

Froehlich, in his original paper, said that the entire symptom complex was the result of the hypophyseal gland lesion. Subsequent observations do not bear out all of Froehlich's assumptions, especially his hypothesis relating to the adipositas which he attributed to a lesion of the pituitary gland. The same type adiposity, as seen in his disease, has been observed in tumors of the base of the brain, in basal meningitis, basal fractures, hydrocephalus internus, accompanied by an intact hypophyseal gland tissue. In hypophyseal tumors, when there did not exist pressure upon the base of the brain, adiposity was not present.

Some little time ago Erdheim expressed himself to the effect that the hypophyseal tumor will only produce adiposity when the growth at the same time produces a lesion of the base of the brain, and that part which is situated at or near the tuber cinereum. Certain authors have raised the presumption that the tuber cinereum is the carbohydrate center and that lesions in that organ are accompanied by disturbance in the carbohydrate metabolism. We can not, as yet, place our finger upon the exact spot where the carbohydrate center is located. However, many highly recognized investigators lean very strongly to acceptance of the tuber cinereum, very close to the corpora mammillaria, as the center, and believe an injury there will be followed by disturbance in metabolism.

Three distinct symptoms have been given due consideration—interference with growth, hypogenitalism, and adiposity. These may justly be called cardinal symptoms in a suprasellar tumor, but there are other symptoms which must be accounted for because invariably present; namely, headaches, visual disturbances, apathy, etc.

#### NEIGHBORHOOD SYMPTOMS

Before proceeding to discuss these clinical manifestations, it is necessary to describe briefly the anatomy surrounding the sella turcica. Situated one on each side of the body of the sphenoid bone are the cavernous sinuses with the carotid arteries and the ocular nerves. Immediately in front are the sulcus chiasmaticus and

the tuberculum sellæ. Behind is the dorsum sellæ. Upon the sulcus chiasmaticus and the tuberculum sellæ rests the optic chiasm, while upon the dorsum sellæ is the pons. Extending upward, forward, and lateralward from the anterior border of the pons are the cerebral peduncles. Immediately above the sella is the base of the third ventricle. The hypophyseal gland, which is lodged within the sella turcica, is attached to the third ventricle by the short hypophyseal stalk and infundibulum. The internal carotid arteries, which emerge on the side of the body of the sphenoid bone, soon divide into the anterior and middle cerebral arteries. The anterior cerebral arteries are united at the base of the brain, just in front of the optic chiasm, by the anterior communicating artery. The anterior cerebral with the anterior communicating form the anterior portion of the circle of Willis. The middle cerebral arteries disappear into the fossa Sylvius almost as soon as given off the internal carotid. They are united to the posterior cerebral arteries, branches of the basilar, by the posterior communicating, thus completing the circle of Willis, within which are the structures constituting the floor of the third ventricle.

A tumor developing from cells about the infundibular stalk would necessarily be within the circle of Willis. As the mass becomes more extensive it produces an ever increasing intracranial pressure, which in a great measure accounts for the headaches. Intracranial pressure of this type is not always accounted for by the presence of foreign bodies. Cushing and Davidoff described an acromegalic who showed a normal sella turcica with no tumor intracranially, yet during the entire time from his twenty-third year to the time of death, a matter of almost 30 years, he suffered most excruciating headaches. It is extremely interesting to note that in this particular case, although the patient showed very marked evidences of acromegaly, post-mortem examination did not disclose a distorted sella nor anything that might be termed a tumor in the sella. Enlarged size of the internal carotid and quite tortuous basilar arteries were observed. The report of this and similar cases makes one feel that intracranial pressure does not always produce cerebral-type headaches. However, in the case of intrasellar tumors the persistent and excruciating headaches can safely be attributed to the increasing size of the tumor which in turn causes an ever-increasing intracranial pressure.

The tumor in its development in every direction has been known to break through the floor of the third ventricle, passing upward, breaking through the foramen of Monroe into the lateral ventricle. Or, as it makes its way forward, it soon comes in contact with the optic chiasm which it pushes before it until checked by the anterior

portion of the *circulus arteriosus*. The new growth, as it becomes ever larger, pushes the chiasm ever more forward until the cerebral arteries are tightly stretched about the optic fibers. Here the arteries beat against optic chiasm with each pulsation, as though they were a hammer forging a tool on an anvil. The fibers soon become atrophic. The writer saw a specimen, not long ago, where along the entire chiasm was a deep groove produced by the anterior cerebral vessels. Visual difficulties up to total blindness are not of infrequent occurrence. The vascular circulation is impeded and markedly disturbed, with an accompanying cerebral anemia. Vertigo, vomiting, failing intelligence, somnolence, apathy, inertia, logginess, and drowsiness follow. The tumor mass may slip along the optic sheath of the optic nerve, breaking through the optic foramen, invading the orbit, dislodging and pressing the optic bulb forward, and producing a *protrusio bulbi*. Or it may imbed itself deeply in the cerebral substance of the frontal lobe. Passing backward, it may invade the cerebral peduncles or the pons. Pushing its way sideways the temporal lobe may be invaded, the uncus severely compressed or even destroyed. Not infrequently, the tumor mass changes its benign character and becomes malignant. The destruction that follows is much greater and much more rapid. In contemplating the invasions of these many vital organs by a growing foreign body it does not take large imaginative powers to conceive of the varied clinical picture with which the clinician is faced.

#### SIMMON'S DISEASE

The function of the pituitary gland seems to be absolutely essential to the needs of life. A total destruction of the same must inevitably lead to death. A thrombosis, an embolus, a tuberculous invasion of the vessels supplying this gland, results in *cachexia hypophyseos*, or Simmon's Disease, which is not unlike that of *cachexia strumapriiva* in its action. *Cachexia hypophyseos* has been mistaken for *lues* and treated as such, even though blood Wassermann and spinal fluid reactions were negative. The disease is invariably followed by gradual weakness, loss of appetite, atrophy of the genitals, and derangement of the sexual activity shown in man by impotence and in women by cessation of menstruation. Appearance of the individual becomes altered. There ensues a gradual falling out of the teeth, hair, atrophy of the breasts, anemia, gradual wasting, weakness, and finally death. Recently, the writer was invited by the pathologist of a leading hospital to examine the history of a female that had died at the age of about 40 years. She first appeared for treatment because of weakness, loss of appetite, and a gradual change of temperament at one of the New York City hospitals. From there she was taken

by her relatives to another well-known institution where the diagnosis of lues was made, and was given antiluetic treatment. Not showing any improvement, she finally reached the hospital where I was invited to look over the records. At this institution she was also given antiluetic medication, although her Wassermann and spinal tap were both negative. On account of the gradually increasing anemia, she was given several blood transfusions, all of which seemed to have no beneficial results. The hospital charts seemed to disclose a typical Simmon's Disease. At the post-mortem examination the pathologist did not find any evidence to account for the clinical picture as observed for several months. After going over the findings of the several organs, and not finding pathologic changes to account for death, the histologic findings of the hypophyseal gland were called for and the writer was informed that an attempt was made to look at the gland and to remove the same, but on account of being very mushy it was left in the cranial vault and not examined. In this case, we were in all probability dealing with a thrombosis of the vessels supplying the gland and which caused degeneration of the pituitary gland.

#### PHYSIOLOGIO HYPERTROPHIES OF THE PITUITARY

The hypophyseal gland can undergo hypertrophies which may be physiologic or pathologic. Pathologic hypertrophies have already been discussed under the heading of acromegaly. Physiologic hypertrophies occur in castrated men and women and animals; further, in aplasias of the thyroid gland, in cachexia strumapriava and myxedema; still further, physiologic hypertrophies occur in normal pregnancies. According to Erdheim and Stumme the principle cells increase markedly in number as well as in size. These authors inform us that the cells become filled with a rich granular protoplasm during pregnancy. The cells which thus undergo this change are called "pregnancy cells" by these same authors. At postpartum the pregnancy cells undergo an atrophy and become indistinguishable from the principle cells. But not all cells which have become pregnancy cells undergo an involution and disappear from the picture as such. Some of them remain permanently, so that the hypophyseal gland remains somewhat permanently enlarged after pregnancy. At each succeeding pregnancy the same process takes place, and after each delivery the gland retains a portion of the increased size permanently, so that in multipara the hypophyseal gland is considerably larger than in virgins.

In man and in nullipara Erdheim found the average weight to be 0.56 gram; in primipara at birth 0.87 gram. The average weight in the multipara after pregnancy is 1.06 gram. The maximum weight in the primipara is 1.10 gram and the multipara 1.65 gram.

The embryonal anlage of the anterior lobe is a small hollow vesicle. Out of the anterior wall of this vesicle the anterior lobe of the pituitary, and out of its posterior wall the pars intermedia of the lower animals, are developed. In lower animals there exists an open hypophyseal space persisting through life remnant of the hollow anlage.

The human being, according to Erdheim, has no pars intermedia. That which is commonly accepted as the pars intermedia in man is rather the so-called Rathke cysts. These, however, are not homologous with the animal pars intermedia, but of the animal hypophyseal space, and are not made of the component parts of the animal pars intermedia but of anterior lobe structure imperfectly differentiated. In function it would necessarily be akin to that of the anterior lobe. The colloid contained in the cysts is, like the colloid found in the anterior lobe, remains of a primitive external secretion. Now, then, since the human does not have a pars intermedia, there can be no disease of the pars intermedia. No changes can take place in what does not exist. For that reason it would be unfair to transfer our observation of the pathology of the pars intermedia of the animal upon man.

It must be distinctly understood that not all authors are of the same opinion regarding the existence or nonexistence of the intermediate lobe. There are some investigators who are very firm in their belief that an intermediate lobe exists in man, while Erdheim is just as firm in his belief that no pars intermedia can be shown to exist. After studies of a large number of microscopic preparations of the pituitary gland under Erdheim and Priesel, I must take my place beside Erdheim in the belief that in man there does not exist any pars intermedia, and what has been described as such, I am inclined to believe are the Rathke cysts.

#### HORMONES OF THE ANTERIOR LOBE

Now a few remarks anent the hormones of the anterior lobe of the pituitary.

First: The hormone elaborated by the eosinophilic cells affects skeletal growth.

Second: The hormone elaborated by the basophilic cells affects sexual characteristics.

Apparently these hormones have an inhibitory action on each other.

The growth hormone is entirely gland specific, that is, up to the present time it has never been obtained except from the anterior pituitary.

The sex hormone may be divided into that which stimulates the follicle of the ovary and that which brings about the luteinization of

the same. These two are frequently considered together as the "master sex hormone" or the "universal nonspecific sex hormone," which is common to both sexes and which activates the gonads and all organs concerned with reproduction. It is the factor responsible for the sexual development which occurs at the age of puberty in both sexes.

This "universal sex hormone" can not be termed exactly gland specific because it has been extracted from placentas, amniotic fluid, blood of pregnant animals and the richest source of all is the urine of pregnant animals. Very early in pregnancy large amounts of the sex hormone are excreted in the urine. This is the basis for the Aschheim-Zondek test for pregnancy in women.

Whether we are dealing with one or two hormones in this "master sex hormone" has not been fully established. It is quite possible that the basophilic cells and the pregnancy cells of the anterior lobe of the pituitary enter into the elaboration of the "master sex hormone."

Evans and Simpson evidently believe that there are two separate and distinct sex hormones, for they make the following statement: "Grounds can be found for the assumption that the stimulant to follicular growth is not identical with that causing luteinization."

*Specific dynamic action of food.*—Kestner, Liebeschütz-Plaut, and Schadow asserted that a hormone secreted by the anterior pituitary was responsible for the specific dynamic action of food substances. These investigators claimed that the absence of this hormone was responsible for the obesity of dystrophia adiposo genitalis. The writer pointed out in this paper that there are a number of instances of lesions of the pituitary which would in all probability interfere with the secretion of the hormone, yet no obesity of the dystrophia adiposo genitalis occurred. On the other hand, in certain cases on record of fracture of the skull, meningitis, etc., without any lesion of the pituitary, a dystrophia adiposo genitalis made itself manifest. In a paper by the writer and published in the UNITED STATES NAVAL BULLETIN of October, 1928, on "The Physiology of the Vegetative Centers," it was pointed out that lesions affecting the tuber cinereum were in all probability responsible for this type of disease. Foster and Smith, in addition, have investigated the German scientists' claim by conducting careful basal metabolic tests with rats. Injections of glycocholate were given to observe the specific dynamic action. These American investigators found that operative removal of the whole pituitary gland did not cause obesity, but that brain injury in the region of the tuber cinereum did cause obesity. This fact is more in conformity with the statements made by the writer in the paper on the cerebral vegetative centers. Removal of the whole pituitary

caused loss of specific dynamic action. This loss was not overcome by replacement therapy, but by means of transplantation of anterior lobes or posterior lobes separately. When both lobes were transplanted the specific dynamic action of glycocoll injections was restored.

When only posterior pituitary was ablated, the level of metabolism was not lowered, but the specific dynamic action of glycocoll was abolished. When injections of bovine posterior pituitary extract were given daily for 10 to 14 days, the deficiency was overcome and glycocoll again showed a specific dynamic action.

#### OTHER FUNCTIONS OF THE PITUITARY GLAND

A good deal of that which follows is quoted from Bugbee, Simond and Grimes.

*Stimulation of thyroid.*—The thyroid gland has been shown to be directly influenced by the hypophyseal gland. Foster and Smith found that removal of the whole pituitary glands in rats caused a 35 per cent reduction in the basal metabolic rate. This was restored to normal by daily transplantation of anterior pituitaries. The transplantation of posterior pituitaries did not affect the basal metabolic rate. Administration of thyroid was effective, however. These investigators observed atrophy of the thyroid in the rats from which the pituitaries were removed. Daily transplants of fresh pituitaries caused repair of the thyroid gland. This evidence together with that of other investigators, Schwartzbach and Uhlenhuth, Crew and Wiesner, leads to the belief that one of the hormones of the anterior pituitary activates the thyroid gland.

*Lowering of gaseous metabolism.*—Lee and Gagnon have reported that daily injection of anterior pituitary extracts, which caused increased growth in rats, also caused a decrease in the metabolic rate. It is possible that the growth hormone itself may stimulate anabolism and at the same time inhibit catabolism. The sum total of the effect may thus be storing up of material in a manner requiring less oxygen and consequently registering lower gaseous metabolism.

*Stimulation of water intake and output.*—Teel observed that dogs which were given daily injections of a preparation containing the growth hormone showed greatly increased water intake and output. In one animal the urinary excretion was 700 cubic centimeters in 24 hours during a control period, and 7,300 cubic centimeters after injections were given. In another laboratory the increase in water metabolism has also been observed, but in a manner which suggested the possibility of a nonspecific action rather than that of a diuretic hormone peculiar to the anterior pituitary.

*Stimulation of lactation.*—Frei, Stricker, and Grueter have observed increased development of the mammary glands with abundant



lactation when anterior pituitary extracts are injected into animals. These investigators believe, however, that the anterior pituitary hormone can cause lactation only in mammary glands which have been previously acted upon by a corpus luteum hormone. Putnam, Benedict, and Teel observed secretion of colostrum in a female dog in which experimental acromegaly had been produced by injections of alkaline extracts of beef anterior pituitaries. No corpora lutea were found in the ovaries upon post-mortem examination. Evans and Simpson observed hyperplasia of mammary apparatus and lactation in adult virgin rats after long continued injection with alkaline extracts rich in growth hormone. Parkes produced scanty lactation in rabbits by injection of alkaline extracts of beef anterior pituitaries and came to the following conclusions: "Control injections into two males and two ovariectomized females gave no results whatever. It is thus clear that the anterior pituitary substance functions entirely through its effect on the ovary, and almost certainly through the luteal tissue produced." "The breakdown changes in the gland which occur when the building-up luteal stimulus is withdrawn appear to initiate lactation."

Recently, Corner has obtained additional evidence which seems to indicate that the corpus luteum is not essential for lactation, but that one of the anterior pituitary hormones, acting alone, is able to cause the secretion of milk. Nelson and Pfaffner have found by experiments with guinea pigs that the anterior pituitary hormone can cause lactation without the aid of the corpus luteum. They have drawn the conclusion that some ovarian hormone must act upon the mammary glands previously to enable the anterior pituitary hormone to produce lactation.

*Decrease of nonprotein nitrogen in blood.*—Teel and Watkins have demonstrated by careful study of the blood chemistry of dogs that there is a marked drop in the nonprotein nitrogen following the injection of alkaline extracts of beef anterior pituitaries. Extracts which caused acromegalic growth in dogs and excessive growth in adult rats produced the fall in nonprotein nitrogen more effectively than any control extracts not containing the growth hormone. The conclusion is drawn that the growth hormone mobilizes the nonprotein nitrogen for the purpose of building up new protoplasm. The nature of the extracts used by Teel and Watkins does not rule out the possibility of active principles, other than the growth hormone, playing some rôle in the control of nonprotein nitrogen in the blood.

*Initiation of bleeding of menstruation.*—Hartman, Firor, and Geiling have discovered that the bleeding of menstruation in monkeys can be initiated by implantation of anterior pituitaries and by injections of extracts of anterior pituitaries or urine of pregnancy. Uterine bleeding resulted from injections of ovarian follicular hor-

mone because of the stimulation of the animal's own pituitary gland. Previous hypophysectomy prevented the uterine bleeding except when replacement therapy was instituted by implants or extracts which supplied the missing anterior pituitary hormone. This brilliant piece of research supplies positive evidence that menstrual bleeding is due to the presence of an anterior pituitary hormone rather than due to the absence of a corpus luteum hormone.

#### SUMMARY

The following distinct physiological functions are claimed by various research workers for the anterior pituitary gland: (1) Stimulation of growth; (2) stimulation of sexual development and ripening of follicles resulting in ovulation; (3) stimulation of lutein cell development, resulting in prevention of ovulation by imprisoning the ova; (4) stimulation of the thyroid gland; (5) stimulation of metabolism by increasing the specific dynamic action of food substances; (6) lowering of gaseous metabolism; (7) stimulation of water intake and output; (8) stimulation of lactation; (9) lowering of nonprotein nitrogen in blood; (10) initiation of the bleeding of menstruation.

Thus far, the posterior lobe of the pituitary gland has yielded two active principles: An oxytocic principle, which causes contraction of the uterus; and a pressor principle, which raises blood pressure.

These two active principles have been separated and obtained in the form of white, stable, water-soluble powders of great potency.

Solutions of these separated active principles have been recombined to form a pituitary extract identical with the original from which they were prepared, thus proving that no decomposition had taken place during the process of separation.

The oxytocic principle, which has been named alpha-hypophamine, causes contraction of uterine muscle when applied by contact. It is nearly free from action on other forms of smooth muscle.

The pressor principle, named beta-hypophamine, does not effect uterine muscle, but stimulates peristalsis in the gastrointestinal tract. It has both a diuretic and antidiuretic effect. It causes expansion of the melanophores in the skin of frogs.

Let us not assume that all of the difficulties in the investigation of the hypophyseal gland have been overcome. There is yet much contradictory evidence noted by investigators. We still need a proper evaluation of the evidence that has come to light within the last several years. That evaluation will surely be forthcoming and when it does we shall have taken a wide step in our definite knowledge of the influences that this small but potent organ situated at the base of the brain within the sella turcica has upon the physiological, biochemical, and pathological functions of the human organism.

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### PILONIDAL CYST

By D. J. WHARTON, Lieutenant, Medical Corps, United States Navy

The relative frequency with which the pilonidal cyst is encountered and the usually unsatisfactory methods of treating it, have caused us to give it serious consideration. We have encountered it forty-four times during the years 1929 and 1930, at the United States naval hospital, San Diego, Calif., leading us to believe it is much more common than is generally supposed.

The term "pilonidal cyst" is applied to a congenital cyst or sinus which is found external or posterior to the sacrum and coccyx. It is also called pilonidal sinus or fistula, sacrococcygeal dermoid, sacrococcygeal cyst, coccygeal fistula, postanal dermoid, and postanal dimple. The word "pilonidal" is derived from the Latin *pilus*—hair, and *nidus*—nest, and is used to differentiate cysts of this character from other cysts or dermoids in the sacrococcygeal area.

Until recently no very satisfactory explanation has been advanced regarding its origin. Abnormalities in development of the neurenteric canal, postanal gut, proctodeal membrane, tail bud, etc., were

used in attempted explanation. None of these explained why the condition was found in its characteristic location only, and had a very uniform structural makeup. Stone (1) has recently pointed out an analogous structure in the oil gland or preen gland found in most species of birds. Stone describes the preen gland as consisting of numerous straight tubules lined by polyhedral epithelial cells. These tubules converge and empty into a collecting chamber which in turn empties through an epithelial lined duct to the skin of the back. There may be from one to six of these ducts, and they lie in or near the midline. The ducts lead cephalad from their orifice. This would seem to offer a more satisfactory explanation than any previously offered.

The cyst communicates with the skin by one, or occasionally more, fistulous tracts. These open in the mid line over the coccyx. Those near the tip of the coccyx may easily be, and in our experience have been, confused with fistula in ano. The orifice is small, 3 to 5 millimeters, round or oval, lined with skin, free from granulations, and frequently a tuft of hair protrudes through the orifice. There may be no opening externally, but in this case dimples are generally present, always in their mid line. There may be combinations of openings and dimples. Openings not in the mid line are the result of an operation or suppuration. It must be remembered that a funnel-shaped depression, the fovea coccygea, is frequently found in this area and corresponds to the point of attachment of the caudal ligament to the skin. It has little pathological significance; occasionally, when very deep, it may be the seat of a low-grade infection.

The cyst is lined with pavement epithelium containing sebaceous glands and also frequently contains hair. The size varies from a small bulblike enlargement at the end of the fistula to a branching affair extending 2 or 3 inches up over the end of the sacrum or an inch or more laterally. It is described as passing around anterior to the coccyx, but we have not met that condition. It occurs more frequently in males than females, the ratio being about 3 to 1.

There are usually no symptoms during childhood and there may be none during adult life. When symptoms are present, they may be only noticeable as a slight sebaceous discharge, or, if the cyst becomes infected, there may be high fever, severe pain, and marked constitutional reaction. It is in this condition that periproctical abscess or an osteomyelitis of the sacrum is suspected.

Examination in the noninfected stage shows the characteristic openings or dimples. If a probe is passed, the fistula is found to be directed upward toward the sacrum. When the opening is near the anus, examination with the finger in the rectum while probing the sinus will usually be sufficient to differentiate this from fistula in ano. If there is doubt, the sinus may be injected very gently with a small

amount of 1 per cent methylene blue solution and the presence or absence of an opening into the rectum established. The initial symptom of either of these two conditions may be an abscess near the anus. The diagnosis is confirmed by the presence of pavement epithelium lining the cyst, or by hair in the cyst. In the infected stage, an abscess is found over the coccyx and sacrum. Abscess of the pilonidal cyst is far more common than osteomyelitis of the sacrum. We have known of cases which had been considered tuberculosis of the sacrum, with prolonged treatment, to be cured by excision of the infected tissue external to the sacrum.

The only satisfactory treatment is complete excision. Incision and drainage, curettage, the use of caustics, or attempts at destruction of the cyst wall by electrocoagulation are entirely inadequate. If the cyst is excised widely enough to get all the branching tracts, a large defect results. The lateral walls of the defect are bound to the gluteal fascia by strong, inelastic fibrous tissue. After the wound has healed, the lateral traction of the nates, when the person is seated, causes sufficient trauma to break down the scar tissue and this process may be repeated several times, so that healing may be delayed for months. We have had one patient who was under continuous treatment for 14 months before permanent healing was obtained. In another, nine months was required to complete the treatment.

To secure rapid healing with a more elastic scar, and therefore a more dependable result, Lahey (2) closed the defect with a lateral pedicle flap. After a wide excision, he cut a lateral skin and flat flap with a broad pedicle from the side of the wound, leaving a defect lateral to the flap. This defect is over soft elastic tissue in the gluteal area, heals readily, and does not break down. We have tried this method thoroughly and consider it a remarkable improvement over previous methods. We had two difficulties with this method, however. We failed occasionally to get union promptly at the lower end of the flap, due to infection, with the result that the sutures cut out and the flap retracted, leaving a midline defect. We also had the tip of the flap slough, with the same defect resulting. In spite of wide excision, infection is very common and we feel that failures will occur more than occasionally where this method is used. We therefore have modified Lahey's method somewhat and will describe our complete method in some detail.

The patient is placed face downward. The table is flat, as bending the table tightens the gluteal muscles, making lateral retraction more difficult. We prefer local anesthesia, and if a block be made well down to the coccyx and sacrum, as well as in the skin, the result is very satisfactory. Caudal anesthesia is not suitable, owing to the danger of passing the needle through the infected tissue of the cyst. The cyst may be injected with methylene blue solution, but extreme

care must be taken to remove all branches of scarred tissue even if not colored. We have not been using the colored solution.

An elliptical incision is used, the size of which depends upon the amount of induration that can be palpated below the skin. This incision ordinarily is about 4 inches, but occasionally up to 6 inches in length, and from 1 to 2 inches wide along the region of the cyst. The dissection is carried downward, the bottom of the wound being carefully inspected as the dissection proceeds to avoid entering infected tissue. This has a darker, cyanotic appearance due to the presence of granulation tissue and shows up well in the yellow fatty tissue of that area. The hard scar tissue of older infections can be recognized by inspection of palpation. When the dissection reaches the fascia over the gluteal muscles, it is turned medially to the midline on top of the dense lumbodorsal fascia. Bleeding is controlled. Ligation of vessels in the dense fibrous tissue is usually best secured by a suture-ligature.

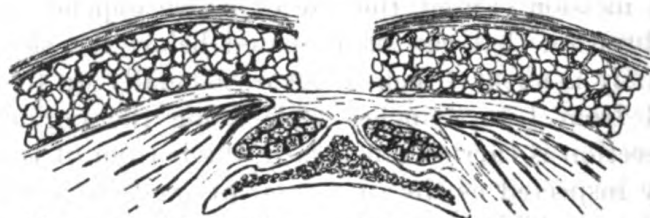
We then obtain a lateral flap, but leave it attached at both ends. This flap is somewhat less than 2 inches wide. It is necessary that the lateral incision be extended farther cephalad than the midline defect to insure the flap sliding over without traction. The caudal end of the defect is usually below the coccyx in soft tissue and the lateral incision need not be carried so far in this direction. The incision goes down to the gluteal fascia and then medial on this to the bottom of the defect, raising the entire length of the flap.

The flap is then sutured tightly down on the fibrous tissue over the sacrum and coccyx and to the opposite edge of the wound. We use one silkworm-gut suture for the full depth of the wound, placing sutures about 1 inch apart. Figure 1 illustrates the method of placing this suture. We believe that the advantages of the flap are lost if it is not properly anchored by sutures. If the defect is extremely large a flap may be made on each side of the defect, thus making two smaller lateral wounds. The lateral wound is packed lightly with gauze. No attempt should be made to close this lateral defect, even after the midline wound appears healed.

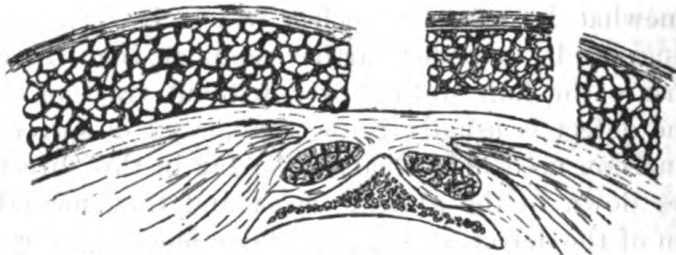
The method may sound elaborate and impractical; on the contrary it simplifies the procedure. The raising of the lateral flap takes only a few seconds. Suturing the wound is then made easier than suturing without a flap.

The advantages are: (1) The patient is in bed only a few days; (2) he may lie in any position he wishes while in bed; (3) healing is rapid and permanent.

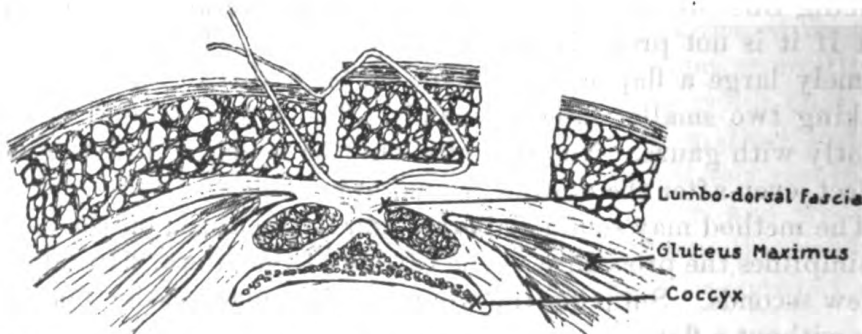
If infection takes place, it may be necessary to remove one suture and separate the skin for drainage, but sufficient drainage usually is obtained through the lateral wound.



A. Showing defect after excision of cyst.



B. Showing flap raised by incision lateral to defect and undermining medially to midline defect.



C. Showing method of placing suture to insure anchoring of flap firmly at bottom and at medial edge.

FIGURE 1.—Operation for Pilonidal Cyst



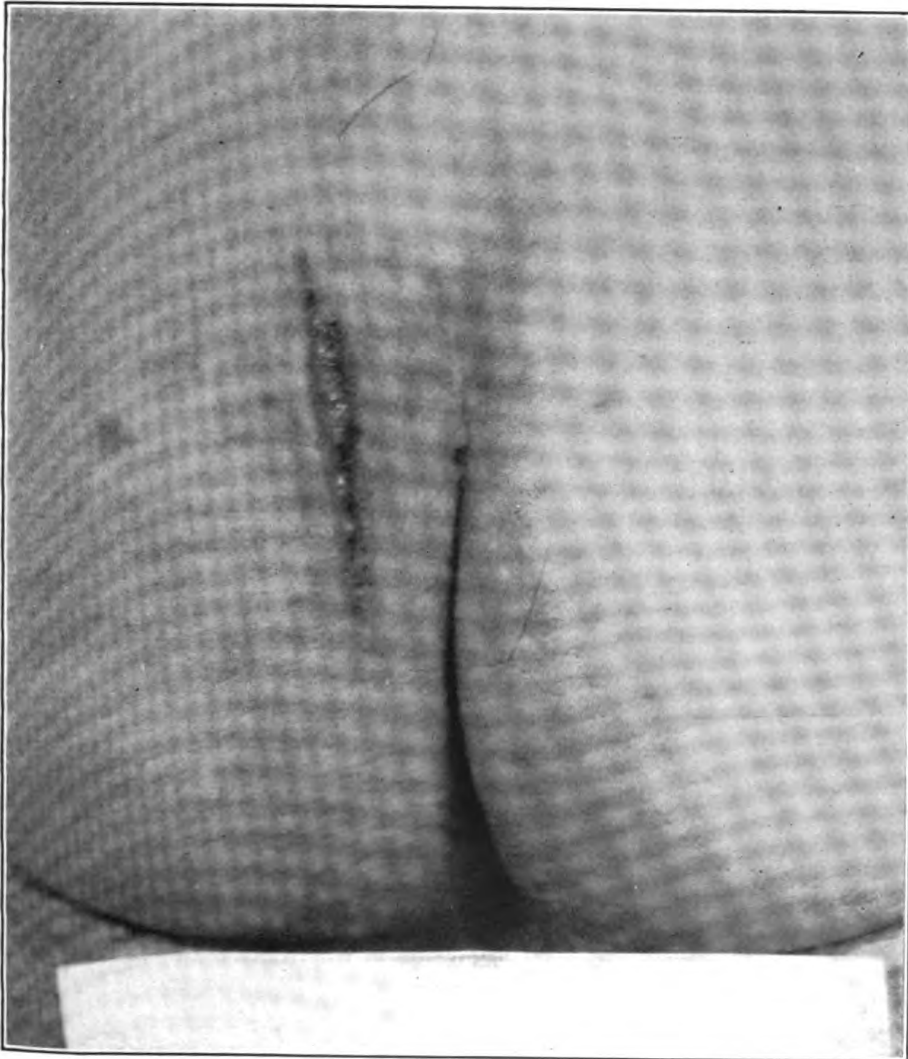


FIGURE 2.—PILONIDAL CYST

Operative wound three weeks after operation. The mid-line wound is healed and the lateral wound is almost healed.





We have had several severe infections, but the flap has held in each case and healing was not materially interfered with. Figure 2 is a photograph of a 3-week postoperative wound in which there was a very severe infection. The wound healed and has remained healed for over a year.

We feel that recurrences will occur only rarely if this method is properly done and that they will be far less frequent than with other described methods.

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#### A BRIEF DISCUSSION OF DIGITALIS

By W. ZUR-LINDEN, Chief Pharmacist United States Navy, Retired

Until about 1898 there was practically no digitalis on the market which could be depended upon for a definite amount of heart stimulation. At times medical men achieved brilliant results in treating heart cases with this drug and at other times they were markedly disappointed in analogous cases which failed to respond to digitalization. Such happenings led an American drug manufacturing firm to investigate methods for delivering to physicians digitalis which could produce a definite action. Soon after this there sprang into existence many chemical tests to determine the cardiac efficiency of various digitalis preparations. The best among these was Keller's color reaction test which was formerly official in the *Pharmacopœia Germanica*. However, this test and all other chemical tests were found to be worthless. Finally a biological test was created, thus placing digitalis on the market with an assured potency. Numerous animals, both warm and cold blooded, have been used to determine the potency of digitalis (frogs, turtles, goldfish, cats, and others).

While biological tests are very valuable there is another side to digitalis which is fully as important—that of cultivation and curing the leaves. Until the ninth revision of the *United States Pharmacopœia* the leaves of digitalis were those collected at the end of the second year's growth at the commencement of flowering. The object of this was to assure a well-matured plant, and it is still an excellent rule to follow. However, the present *United States Pharmacopœia* does not require the leaf to be gathered at any certain time, but insists on a biological assay using essentially Hale's 1-hour frog method which has for years been considered as the most reliable. The

United States Pharmacopœia frog test is not infallible, but due to the fact that there was no better test the United States Pharmacopœia revision committee again reintroduced it in the United States Pharmacopœia X. Hatcher uses "cat units" which have gained recognition with pharmacologists.

Getting back to the leaves—improperly cured leaves undergo fermentation which rapidly destroys the active glucosides. Glucosides are esters of carbohydrates, and their potency is rapidly influenced by ferments which cause decomposition quite similar to fermentation of glucose. Considerable care is required to keep the leaves from remaining moist and becoming clumped together while drying, and leaves that are not fully grown or contain blemishes should be rejected. Many years ago a group of physicians sought to demonstrate that the leaves of the wild plant were superior to those from cultivated plants, but after a series of experiments in a Philadelphia hospital it was distinctly demonstrated that the cultivated plant produced the more active drug.

After the leaves have been dried the problem of storage is very important. In the United States naval hospital, Portsmouth, Va., it was determined that active digitalis leaves soon lost their strength when stored in paper containers. When stored in amber glass bottles and tin canisters they retained their potency for a very long time.

Before discussing the United States Pharmacopœia preparations of digitalis it is desired to comment on animal experiments. The writer in a course of animal experiments demonstrated that the same drug in different animals produces widely different results and that the results of animal experimentation must be used with great care when applied to man. It was found that cats could tolerate enormous doses of arsenic but dogs receiving only one-tenth as much (per kilogram of body weight) died rapidly. It is a known fact that pigeons can eat belladonna leaves with impunity but mammals are rapidly poisoned by them. Using Hatcher's cat method for assaying tincture of digitalis the results indicate that tincture of digitalis will retain its potency for approximately five years, but the United States Pharmacopœia frog test shows it to be comparatively worthless about one year after its manufacture. The United States Pharmacopœia test and clinical results agree closely. The cat and the frog are too widely separated for accurate biological comparison. Biological tests require specially trained personnel and scientific laboratory apparatus thus making it impracticable for the average pharmacist and physician to test their digitalis. Again proper sized frogs are hard to procure and temperature variations make a big difference in tests; for this reason the cat method deserves further study as cats are easy to procure.

A number of years ago the various pharmaceutical and medical schools taught that the water soluble principles of digitalis were diuretics and were practically inert in so far as heart stimulation was concerned. They also taught that the alcohol soluble principles were active heart tonics but practically inert as diuretics. To-day there is a tendency to discredit this idea, but the writer has demonstrated to his satisfaction that the former were more accurate. The United States Pharmacopœia recognizes the dried leaf of digitalis and two preparations made therefrom and it may appear strange, but each possesses advantages over the other two. The infusion contains the water-soluble principles (principally digitonin and a small amount of glucosides that are both water and alcohol soluble) which are active diuretics and more or less cardiac depressants. The tincture contains the active principles which are alcohol soluble (principally digitoxin and digitalin) which are active cardiac tonics. From the above it will be seen that neither the tincture nor the infusion represent the full medicinal virtues of digitalis hence the necessity for the leaves being official. Only the leaf represents the full medicinal virtues of the drug which fact has been demonstrated clinically numerous times. If the tincture is employed care must be taken that it is less than one year old. A prominent drug manufacturer makes the following statement on his containers of tincture of digitalis, "This preparation was manufactured 10 per cent stronger than the United States Pharmacopœia standard. It is recommended that after 18 months that it not be used." If the infusion is used it must be freshly prepared contrary to the statements which have appeared in medical journals that it is active indefinitely.

Many failures attributed to tincture of digitalis are due to the fact that nurses and Hospital Corps men count drops from a medicine dropper as minims which is extremely inaccurate. The writer made a series of experiments using medicine droppers furnished through the United States naval medical supply depot, Brooklyn, N. Y. On an average, these droppers at 75° F. dropped one-third of a minim per drop and the nurse on duty in the heart ward was giving patients 15 drops representing about five minims instead of the prescribed 15 minims. The average hospital ward is not equipped with measuring vessels which will measure 15 minims. Digitalis preparations made from the tincture and combined with water or water and sirupy mixtures rapidly hydrolize thus becoming worthless in a very short time. To assure accuracy in dosage and therapeutic potency it is reliable to dilute 1 part of the tincture to 4 with the United States Pharmacopœia menstrum used in making digitalis tincture thus producing a preparation in which 1 fluid drachm represents 15 minims of tincture of digitalis.

In conclusion it may be stated that the United States Pharmacopœia does not go far enough when it makes mandatory the biological assay. It should also insist that the manufacturer shall state on his containers the date of manufacture and biological assay so that tincture of digitalis used at the bedside will be dependable and will produce definite heart stimulation. The writer's past experience would lead him to recommending only the use of the whole leaf tablets which have been stored in amber glass tubes bearing the date of manufacture and biological assay as determined by the United States Pharmacopœia frog method or Hatcher's cat method.

## CLINICAL NOTES

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### EVENTRATION OF THE DIAPHRAGM

#### REPORT OF CASE

By P. P. MAHER, Lieutenant Commander, Medical Corps, United States Navy, and J. D. BLACKWOOD, Jr., Lieutenant Commander, Medical Corps, United States Navy

As eventration of the diaphragm is a rare condition and one not frequently diagnosed during life, the following case is reported.

Eventration is not as frequent as hernia of the diaphragm—the ratio has been stated to be 1:37. It is purely an anatomical defect, generally congenital due to an inborn weakness of the diaphragm and nearly always occurs on the left side. It may, however, be produced by a crush wound of the lower thorax or upper abdomen or by a sudden doubling of the body with the knees against the chest.

Various theories have been advanced as an explanation of this anomaly, viz: (1) Injury to the phrenic nerve at birth causing a subsequent degeneration of the diaphragm; (2) congenital lung hypoplasia on the affected side with an elevation of the diaphragm to fill the vacant space; (3) the radical difference in the formation in the foetus of the right and left diaphragm; and (4) chronic gaseous distention of the stomach or bowel with pressure on the diaphragm causing circulatory disturbances with resulting degeneration of the musculature and stretching.

The age limits of the cases previously reported have ranged from the foetus to 75 years of age.

Treatment is purely palliative if, indeed, any treatment is necessary. Surgical treatment should not be attempted unless absolutely necessary, as death has occurred when the abdomen was opened or has occurred in asystole due to the sudden return of long displaced organs to normal position. Due to the thinness of the eventrated diaphragm plication is stated to be practically impossible.

Frequently there may be no subjective symptoms. In some cases the subjective symptoms are thoracic, viz: Palpitation, tachycardia, dyspnoea, cough, and pain. Again they may be abdominal, namely, dyspepsia, gastric pain, belching, vomiting and hematemesis. General symptoms may include loss of weight, weakness, cyanosis, anxiety, neurasthenia, and melancholia.

These cases have been divided into three types: (1) Pleuropulmonary, (2) dyspeptic, and (3) cardiac.

## CASE REPORT

A. H. F.: Hospital apprentice, first class, on duty in the tuberculosis ward at the Norfolk Naval Hospital, Portsmouth, Va., requested a chest examination because he was losing weight.

*History.*—About two years ago the patient began to feel pain at the end of the ensiform cartilage. The pain extended upward and outward over the right side of his chest. At times when he takes a deep breath he has pain down the right arm as far as the elbow. There is marked belching with occasional vomiting of a sour and burning material. He also complains of dyspnoea and pain in the chest with palpitation of the heart upon undue exertion. There is no history of injury and his previous health record is negative.

*Physical examination.*—The patient, although thin, showed a fair muscular development. The chest was well formed and showed equal and good expansion. The apices, when mapped out by percussion, were equal and broad. The bases were equal, but the left expanded slightly less than the right. The breath sounds were normal throughout the chest anteriorly and posteriorly except as noted below.

Vocal resonance was normal excepting over the left base posteriorly where it was slightly diminished. Upon percussion, which was charted before the chest was auscultated, there was noted in the left axilla below the sixth rib an area of impairment. Between this area of impairment and the heart, which occupied a position more to the right than normal, there was an area of tympany extending upward to the fourth rib when the patient was standing. Over this tympanitic area the breath sounds were weak and there were noted crepitant râles, which resembled the sounds of peristalsis rather than intra or extra pulmonary crepitations. A coin test over this tympanitic area was negative. No signs of tuberculosis were elicited.

An X-ray of the chest was taken and a tentative diagnosis of eventration of the left diaphragm was made.

*X-ray examination of the chest.*—Under the fluoroscope the heart shadow is displaced to the right. The right diaphragm appears normal in position. The left diaphragm is elevated, the highest point reaching the level of the fourth rib anteriorly. On deep inspiration the left diaphragm descends, but its excursion appears diminished. The paradoxical diaphragmatic reflex associated with diaphragmatic hernia was not present. The gas bubble was below the diaphragmatic outline.

The patient was then reexamined physically while in a supine position in an endeavor to elicit further physical signs which would be of assistance in diagnosing this condition, and was also subjected to various tests to determine what effect this abnormality had upon his physiological reactions. When lying upon his back the heart was found to occupy a position still more to the right, extending from the mid-sternal line (left border of the heart) to the right mid-clavicular line (right heart border), and the area of tympany previously noted extended from the left heart border to the left mid-axillary line and upward to the superior border of the fourth rib on the left side. Above the fourth rib could be heard vesicular breath sounds and increased vocal resonance while below (over the area of tympany) could be heard peristaltic sounds, a diminished vocal resonance, and an absence of breath sounds. The peristaltic sounds were also heard along the left border of the sternum above the tympanitic area. A coin test over this area of tympany was again negative. Heart sounds while more marked over the area occupied by the heart, were also transmitted to the right and left.



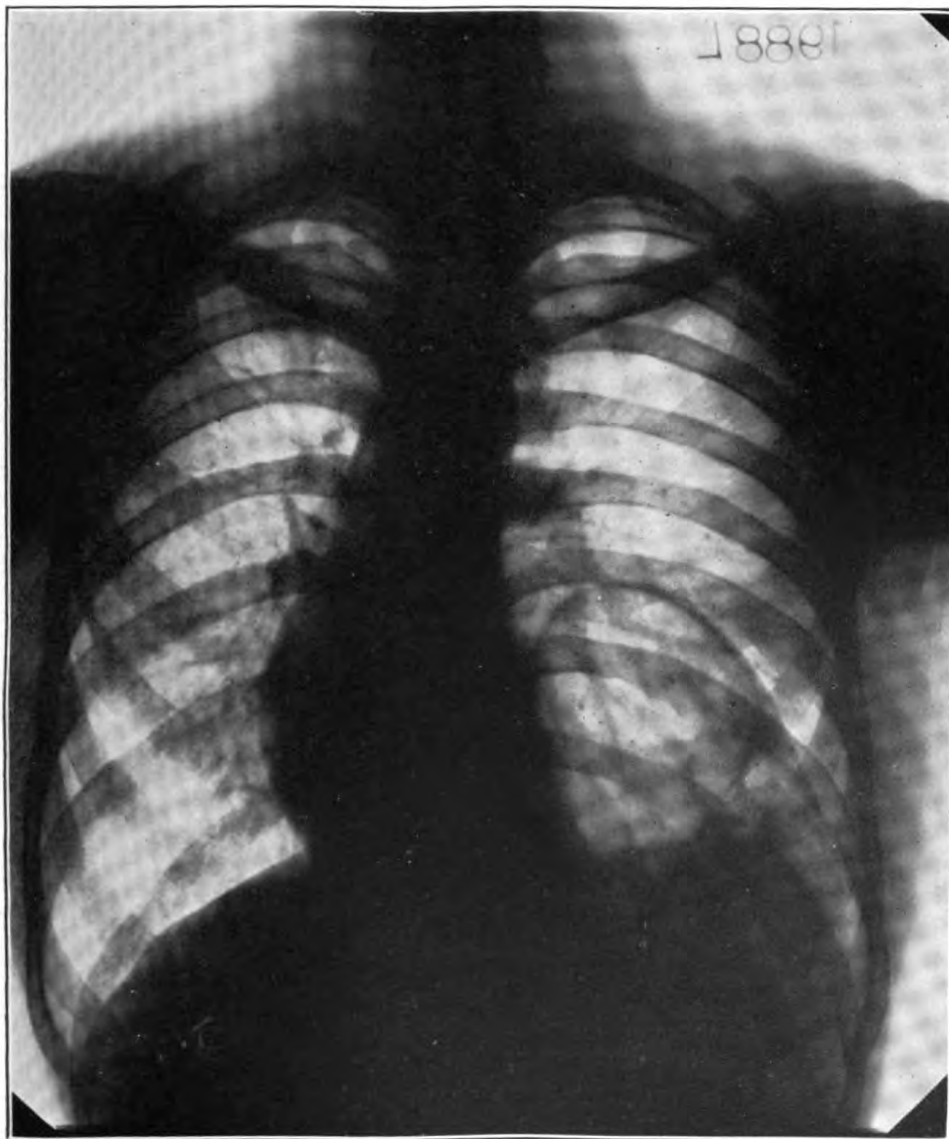


FIGURE 1.—EVENTRATION OF DIAPHRAGM

Showing high position of left diaphragm and displacement of the cardiac shadow to the right.

360—1



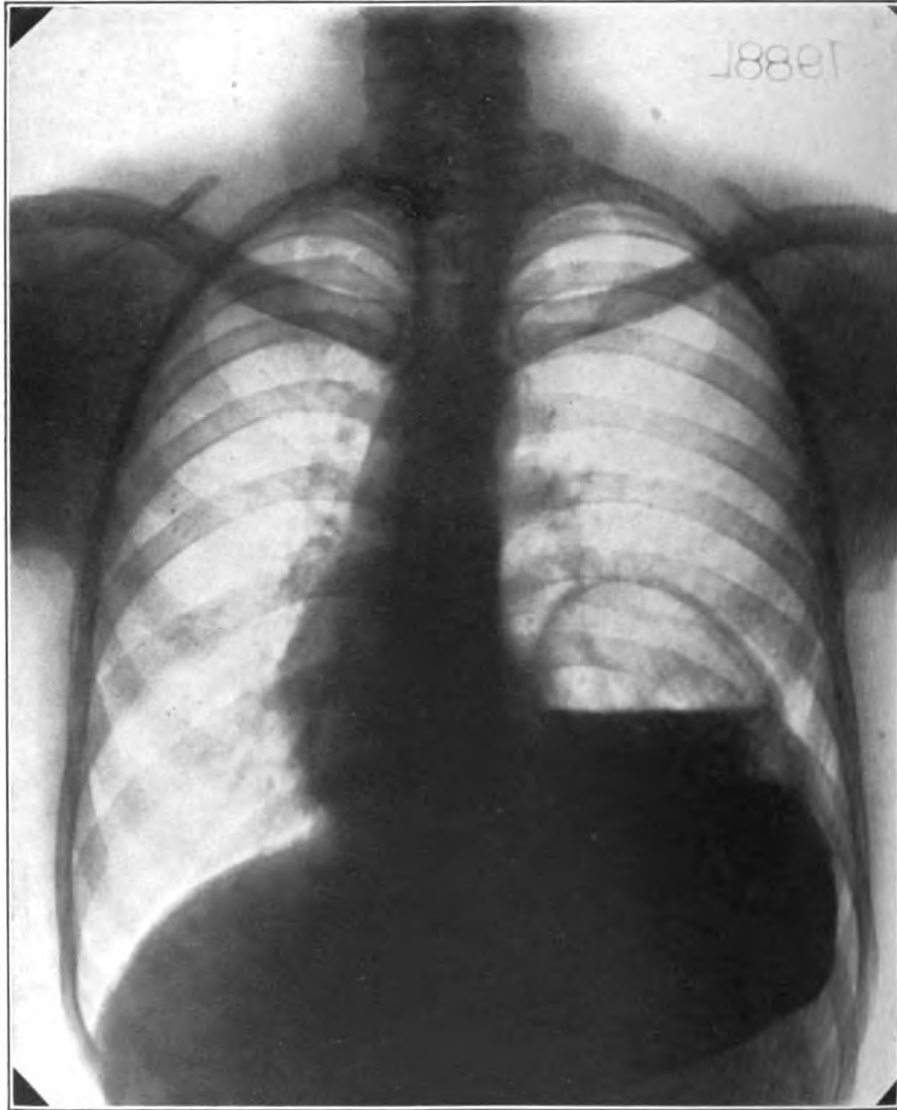


FIGURE 2.—EVENTRATION OF DIAPHRAGM

Patient in upright position, with stomach partially filled with barium, showing spilling-over defect from cardiac to pyloric portions.

360-2



FIGURE 3.—EVENTRATION OF DIAPHRAGM

Patient in prone position with sufficient tilt to fill pyloric half of stomach and show barium-coated cardiac half.

360—3





With the patient standing the bases of the lungs were again mapped out and found to be equal in height, but with a slightly lessened expansion upon forced inspiration on the left side. There was no paradoxical respiratory sign as may be noted in hernia of the diaphragm, i. e., the base ascends instead of descends on the affected side upon forced inspiration.

When the patient was in a prone position the left base was slightly more resonant to percussion than the right, but no tympany was obtained.

Fractional gastric analysis failed to show any disturbance of the normal physiological secretions.

*Fractional gastric analysis*

No.	Free HCl		Total acidity	
		Per cent		Per cent
0.....	28	0.1	52	0.18
1.....	16	.05	36	.13
2.....	24	.08	44	.16
3.....	26	.09	44	.16
4.....	36	.13	48	.17
5.....	34	.12	67	.24
6.....	18	.06	38	
7.....	66	.24	80	
8.....	74	.27	90	.32

Bile, negative; blood, negative; lactic acid, negative; residual, 40 cubic centimeters.

An electrocardiogram gave a negative tracing.

*Electrocardiogram*

Rate.....	75.
Rhythm.....	Regular.
P-R interval.....	0.19 second.
Opinion.....	Negative.
Blood pressure (2 p. m.).....	8/100 D/64.
Pulse pressure.....	86.
Heart load.....	56 per cent.

*Gastrointestinal series.*—The patient was given two glasses of barium sulphate mixture. The œsophagus appeared to follow a normal course. The cardiac opening was in its usual position in reference to the diaphragm.

As the barium entered through the cardia the fluid line ascended in the cardiac portion of the stomach. This ascent continued up to a certain point, when a spilling over or waterfall effect was noted. Barium could then be seen at two levels. As the barium left the pyloric portion of the stomach the duodenal bulb was seen almost 1 inch below the cardiac opening. By elevating and lowering the patient's horizontal position the barium could be made to flow from the pyloric portion to the cardiac portion, and vice versa. Films made of the chest confirmed the high position of the left diaphragm and the displacement of the cardiac shadow to the right. The presence of the barium in the pyloric division with a very slight coating in the cardiac end is clearly shown.

Films taken at 3, 6, and 9 hours after the barium show complete emptying of the stomach in less than three hours and normal passage through the small and large intestines. The high position of the splenic flexure is demonstrated.

The findings in this patient are believed to show a case of eventration of the diaphragm.

## DIFFERENTIAL DIAGNOSIS

As the main physical sign (by percussion) was the large area of tympany in the chest where normally one should elicit resonance or cardiac dullness, pneumothorax suggests itself.

*Pneumothorax.*—The area of tympany should not change with a change of position of the patient; there would be no peristalsis heard over the area; a coin test might be elicited; the patient would be more dyspnoeic and there would be a history of sudden, sharp pain followed by marked dyspnoea or of an artificial pneumothorax.

*Hernia of the diaphragm.*—While this may be congenital, there is more apt to be a history of injury. Signs and symptoms of intestinal obstruction are more apt to be the cause of the discovery of this condition. The paradoxical respiratory sign will differentiate hernia from eventration.

## SUMMARY

(1) Eventration (elevation) of the diaphragm is a rare condition; generally congenital and most often on the left side.

(2) It is generally diagnosed by X ray.

(3) The means of differentiating by X ray an eventration and a diaphragmatic hernia is by the presence of the paradoxical respiratory sign in hernia.

(4) The physical signs elicited were: (a) displacement of the heart; (b) an abnormal area of tympany which grew in extent when the patient was supine; (c) peristaltic sounds over this tympanitic area; (d) absence of breath sounds over this same area; and (e) absence of the paradoxical respiratory sign when the bases were mapped out by percussion before and after full inspiration.

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## ASEPTIC (LYMPHOCYTIC) MENINGITIS

## REPORT OF TWO CASES

By P. F. DICKENS, Lieutenant Commander, Medical Corps, United States Navy

The establishment of a diagnosis in patients showing signs and symptoms of cerebrospinal involvement at times becomes a puzzling

problem and this is especially true of those patients showing a lymphocytic cellular response in the cerebrospinal fluid. An early diagnosis is desired, and the fact that the lymphocytic cellular element of the cerebrospinal fluid narrows the field of types of meningitis to be investigated does not prevent one from now and then encountering cases in which no definite diagnosis based upon etiology can be established.

Viets and Watts<sup>1</sup> report five cases of meningitis characterized by an acute onset, headache, vomiting, and moderate fever. There was some degree of blurring of the optic disk in all cases. The cerebrospinal fluid showed a marked lymphatic pleocytosis without polymorphonuclear cells. Slight protein increase but with sugar and chloride content in the normal range. No organism could be obtained. The spinal fluid pressure was higher than normal. The disease reported was self limited, lasting from three to six weeks, and recovery took place without residual paralysis.

As stated by these authors "patients showing a severe lymphatic pleocytosis in the cerebrospinal fluid form a small but important group under the general classification of meningitis." Cases of this kind present a delicate diagnostic problem.

Two patients with the syndrome described by Viets and Watts are reported, one observed by the writer and one originating on the U. S. S. *Lexington* and reported by letter to the Bureau of Medicine and Surgery by the *Lexington* and naval hospital, San Diego, Calif.

#### CASE REPORTS

**CASE 1.**—G. E., male, age 33, married. First seen October 28, 1931, complaining of severe occipital headache, nausea, and soreness of muscles.

Two weeks before admission patient stated he had had a severe cold with considerable coryza. This cleared within a week but was followed by herpes labialis. On admission residual of herpes remained. The complaint at time of admission was headache, nausea, and sore muscles.

**Examination.**—Temperature, 102; pulse, 88; respiration, 20. Teeth: Several old roots showing shadow by transillumination. Throat infected, but tonsils out clean. Some crusting in nose and on posterior pharyngeal wall. Posterior cervical and inguinal glands palpable but not axillary or epitrochlear. No rash or erythema.

Chest, heart and abdomen normal. The positive findings in addition to palpable post cervical and inguinal glands were as follows: Stiffness of neck, bilateral Kernig, and seemingly hyperactive knee jerk. The disk margins were blurred.

**The laboratory examinations** revealed red blood count, 4,850,000; hemoglobin, 85 per cent; white blood count, 8,000. Differential: polymorphonuclear leucocytes, 60; lymphocytes, 35; others, 5. Blood serum Kahn—negative.

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<sup>1</sup> Viets, H. R., and Watts, J. W., Aseptic (Lymphocytic) Meningitis, J. A. M. A., 93: 1553, Nov. 16, 1929.

*Spinal fluid*

Day	Date	Cells	Pressure, milli- meters of mercury	Protein	Sugar	Chlorides
A.....	Oct. 28	1,255	20	60	70	700
2.....	Oct. 29	1,520	15	60	65	650
5.....	Nov. 1	950	10	-----	50	700
9.....	Nov. 5	722	7	30	60	675
14.....	Nov. 10	120	7	20	55	720
20.....	Nov. 16	18	10	22	64	680

The only cell found in the spinal fluid was a lymphocyte. Culture on the fourth, seventh, and ninth day negative. Animal inoculated and killed at end of five weeks showed no evidence of tuberculosis. Colloidal gold curve on October 28, 1931, was 0-0-1-1-2-1-1-0-0-0-. Repeated laboratory studies on spinal fluid failed to demonstrate any organism, and no pellicle formed in the fluid either at incubator or ice-box temperature. Patient requested two spinal punctures to relieve headache. X ray of head and chest failed to demonstrate evidence of tumor, abscess, or tuberculosis. Patient recovered on symptomatic treatment and nursing. Kahn and Wassermann negative both on blood serum and spinal fluid. Blood pressure on admission, systolic, 130; diastolic, 80; and on discharge, systolic, 120; diastolic, 75. The temperature from October 28 until November 5 ranged from 99.5° F. in a. m. to 102.2° F. in p. m., falling to normal on November 8 and remaining there. Six weeks after admission no evidence of the disease could be found, and when last seen January 23 no evidence of disease was present.

CASE 2.—Origin—U. S. S. *Lexington*. On admission July 25, 1931, this patient complained of constant headache. Examination revealed mild rigidity of neck and back. Temperature, 100; pulse, 80; respiration, 20; white blood count, 7,400. Differential: Polymorphonuclear leucocytes, 72; lymphocytes, 18. Urine negative. On July 27 patient became somewhat lethargic and complained of severe headache. Temperature, 101.4° F.; pulse, 90; respiration, 25. Patient stated he had had a cold some two weeks previous, but that it had cleared up. He noticed that his legs, back, and neck were a little sore and stiff.

*Physical examination* revealed a well-developed and well-nourished male, age 20, somewhat lethargic but in no apparent distress. Neck was stiff and there was some soreness of muscles of back. The patient complained of pain when one attempted to flex chin on chest. Pupils equal and react to light and accommodation. Vessels of fundi injected. Tonsils and pharynx injected. Lungs, heart, and blood vessels negative. Blood pressure, systolic, 126; diastolic, 72. Bilateral Kernig present. Babinski and Gordon negative. Deep reflexes present and active. Temperature ranged from 100° F. on admission to normal throughout his stay in hospital.

*Laboratory examinations.—**Spinal fluid*

Day	Date	Cells	Sugar	Chlorides
A.....	July 27	2,500	-----	-----
3.....	July 29	1,750	42	684
4.....	July 30	-----	34.5	684
8.....	Aug. 4	350	42	693



Colloidal gold negative. Kahn negative. Wassermann negative. Pandy positive. Culture, no growth after three days. Urine showed albumin on one examination. Sugar negative. Specific gravity 1.024. Acid reaction.

The cells of the spinal fluid reported as lymphocytes. X ray of chest negative. Search in this case was made for typhoid, para a and b, and other organisms with negative results. On August 17, 22 days after onset, patient was without symptoms, and on September 4, 39 days after onset, patient was returned to full duty and was free from any signs or symptoms of his illness.

This patient was in the United States naval hospital, San Diego, Calif., from July 28, 1931, until September 4, 1931, and the clinical and laboratory study was made by that institution and we have abstracted the health record in this case as it is believed to fall into the group of cases of meningitis with a lymphocytic cellular response.

#### COMMENT

During the last decade there has been a steadily increasing tendency to perform lumbar puncture early in cases showing any sign or symptom of cerebrospinal irritation. This is a commendable procedure and undoubtedly allows the clinician to arrive at a laboratory diagnosis and institute appropriate treatment at a much earlier stage than to wait until definite signs and symptoms of cerebrospinal involvement become sufficiently evident to render a diagnosis reasonably accurate. No one should condemn an attempt to establish an early diagnosis of anterior poliomyelitis, cerebrospinal fever, tubercular and other bacterial meningitis cases, syphilitic disease with cerebrospinal involvement, or to definitely exclude these diseases in a patient who presents cerebrospinal symptoms by early and repeated lumbar puncture.

By courtesy of Dr. Walter A. Bloedorn, commander, Medical Corps, United States Navy (retired), professor of medicine, George Washington University, the writer had the opportunity to observe and use as clinical material for the class of the naval medical school two additional patients presenting this syndrome. It is not plausible to contend that one would have the opportunity in the course of some four months to observe three cases of poliomyelitis without paralysis, or to observe the same number of patients get well with tubercular meningitis; also it might be stated that it is hardly likely that Viets and Watts should have seen five cases of poliomyelitis without evidence of paralysis or that they should see five cases of tubercular meningitis with recovery.

The fact that the cellular element was entirely lymphocytic excluded many forms of meningitis and usually causes one to make a working diagnosis of tubercular meningitis or poliomyelitis without paralysis. The following conditions were given careful consideration, neurosyphilis, encephalitis, polyneuritis, herpes zoster, disseminated sclerosis, and such diseases as mumps, influenza, etc.; but no data could be obtained to justify a diagnosis of any of these condi-

tions, and like the cases reported by Viets and Watts, the etiology remains unknown.

What is this condition? Is it acute anterior poliomyelitis without paralysis, syphilis with a negative laboratory diagnosis, epidemic encephalitis, or is it a new entity due to a filterable or nonfilterable virus?

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#### **ELECTROCARDIOGRAPHIC EVIDENCE OF RECENT CORONARY OCCLUSION, WITH SPECIFIC EMPHASIS ON THE USE OF THE ANTERIOR-POSTERIOR CHEST LEAD**

By C. W. ROSS, Commander, Medical Corps, United States Navy, and DAVID FERGUSON, Lieutenant Commander, Medical Corps, United States Navy

The electrocardiographic evidence of recent coronary occlusion varies from pathognomonic tracings to those showing no discernible departure from the normal.

A very important electrocardiographic change was reported by Pardee (1920). It is characterized by the T wave arising from the descending limb of R well above the isoelectric level, thus forming a convex curve at the R-T juncture. This sign may appear from a few hours to a few days after the coronary accident. It may not be found, possibly because of the rapid changes which occur in the form of the electrocardiogram following coronary damage.

Electrocardiographic changes involving the T wave occur in conditions other than coronary occlusion. In these other conditions, with the exception of changes induced by digitalis, the anomaly develops over a long period of time. Therefore, if these T wave anomalies show further changes in form from day to day, the diagnosis of recent coronary occlusion is established.

Levine (1929) called attention to the frequency with which this sign is found to be reversed, i. e., a T wave arising well below the isoelectric level from S.

The T wave at first may be present as a broad rounded curve. Later it may gradually invert as a late, deep V-shaped depression.

Levine (1926, 1929) noted the frequent occurrence of deep Q waves in lead 3 in his study of 145 cases of coronary thrombosis. Among 83 patients from whom electrocardiographic tracings were obtained, deep Q waves were present in lead 3 in 13 instances.

Pardee (1930), independently of Levine, investigated this same anomaly in 200 cardiac patients. Of 30 having an angina syndrome 27 per cent had large Q waves in lead 3. However, 3.5 per cent of cardiac patients with no evidence of coronary disease also showed this Q wave anomaly, and 7 per cent of patients with coronary disease did not have this sign. No records showing right axis deviation were considered, as Q 3 is a normal feature of these curves. Trac-

ings showing an M or W shaped Q 3 were also excluded. Tracings showing variations in the amplitude of the complexes in lead 3, due to respiratory effects on the electrical axis of the heart, were not included. Pardee requires that the string standardization of each lead be photographed. Tracings which show a variation of more than 1 millimeter in a 3 millivolt deflection are rejected. An abnormally large Q 3 is arbitrarily considered to be one that is greater than 25 per cent of the amplitude of the largest ventricular deflection in any of the three leads.

Wolferth and Wood (1932) have reported an important electrocardiographic sign of coronary disease which is obtained by the use of chest leads. This lead is obtained from German-silver electrodes applied over moist saline pads on the front and back of the chest at the cardiac level and to the left of the midline. The anterior electrode is connected to the right arm lead wire; the posterior to the left.

The anomaly of recent coronary occlusion was shown in this lead to be a depression of the S-T interval below the isoelectric level.

The normal chest lead was established from tracings of 20 individuals without heart disease and 13 patients having cardiovascular disease; the latter presumably representing no cases of coronary disease. The characteristics of the normal chest lead are given as: P-wave often inverted; QRS often of greater amplitude than other leads; a deeply inverted T wave; no deviation from the isoelectric level in the S-T interval.

The writers report two cases illustrating the anomaly in the tracing from the chest lead; tracings from the conventional leads made simultaneously do not show definite evidence of coronary occlusion.

While it is not within the scope of this paper to discuss the clinical aspects of recent coronary occlusion, this diagnosis should be suspected on finding certain clinical phenomena. Oftentimes, however, the diagnosis can not be made with certainty without definite electrocardiographic evidence.

#### CASE REPORTS WITH ELECTROCARDIOGRAMS

The cases herein reported represent different clinical types of coronary accident, but all pursuing a rather typical clinical course. Briefly, two cases had an onset preceded by definite anginal symptoms; in one a history was obtained of a similar attack a year previously, with a period of hospitalization lasting a month, at which time unfortunately no electrocardiographs were made, and a diagnosis (most probably erroneous) of chronic cholecystitis was given; the second complained of anginal symptoms for a period of two weeks

prior to the onset of the typical clinical picture of occlusion. The third case presented a classical picture of sudden and dramatic onset and complete disability.

CASE 1.—J. W. O.; machinist; age, 44 years. Known to have a hypertensive heart disease with a systolic blood pressure of 250 millimeters of mercury. Admitted February 17, 1932, complaining of a sudden severe substernal pain which developed on February 13. The pain was not relieved by nitroglycerine and there was a sense of impending disaster. For the past two weeks has suffered from vague epigastric discomfort following physical exertion. Residual soreness and recurrence of acute substernal pain persisted until admission. Temperature, 99.6° F.; pulse, 110; respiration, 20.

*Physical examination.*—(1) Moderate obesity; (2) moderate dyspnoea with slight cyanosis of the ears and finger tips, associated with anxious facies; (3) eye grounds negative; (4) few fine moist râles in both bases; (5) apex impulse in the fifth space at the midclavicular line, the first sound is split, no thrills, no murmurs, no pericardial friction, and rhythm regular. Blood pressure, 178/118. White blood count, 9,950.

February 29, 1932: Blood pressure, 148/96. (See Figure 1.)

CASE 2.—E. C. S.; warrant officer, United States Marine Corps; age, 46 years; admitted August 21, 1931. On August 17, 1931, while at sea, following several strenuous sets of deck quoits, developed severe precordial pain, radiating down the left arm, weakness, and immediate disability. Temperature, 99.2° F.; pulse, 100; respiration, 20.

*Physical examination.*—Heart, size normal, gallop rhythm present, no murmurs and no pericardial friction. Blood pressure, 96/60. (Systolic blood pressure in January, 1931 was 154 millimeters of mercury.) White blood count, 8,500; polymorphonuclears, 80 per cent.

September 25, 1931: Blood pressure, 100/60; pulse, 80–100. Slight fever.

October 3, 1931: Blood pressure, 112/74; pulse, 80–90. Afebrile.

January 18, 1932; Blood pressure 116/74; pulse, 72–80. Afebrile. Surveyed to sick leave. (See Figures 2 and 3.)

CASE 3.—E. L. M.; Veterans' Bureau patient; age, 64 years; admitted July 27, 1931. Complained of tenderness and soreness over the lower sternum and in the region of the gall bladder. Has a previous record of a month's hospitalization about a year ago for symptoms similar to those now present. At that time a diagnosis of chronic cholecystitis was made, and it was noted that he had hypertension—blood pressure, 170/100. Temperature, 99.2–101.4° F.; pulse, 110; respiration, 18, on day of admission.

*Physical examination.*—Evidence of general arteriosclerosis. Heart enlarged downward and to the left; there is a short systolic murmur. Regular rhythm. Blood pressure, 146/100. Tenderness increased on pressure in the gall bladder area. Liver and spleen not palpable. White blood count, 14,600.

Irregular fever, rapid pulse, and leukocytosis continued until September 1, 1931.

September 15, 1931: Has been without pain and fever for the past two weeks. White blood count, 7,400. Blood pressure, 164/100. (See Figure 4.)

#### COMMENT

Two cases are reported with electrocardiograms showing the importance of the Wolferth-Wood contribution as an aid to the diagnosis of coronary occlusion.

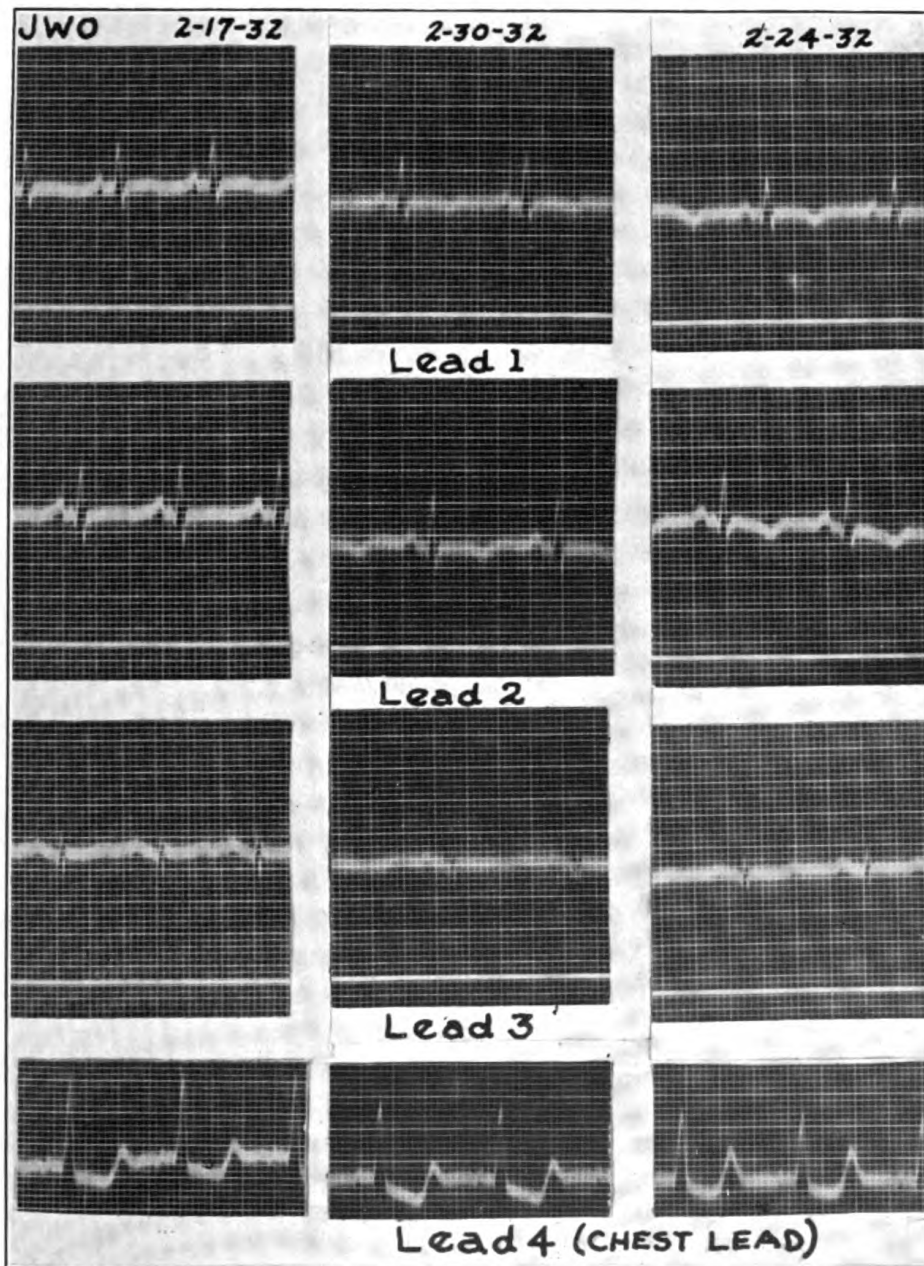


FIGURE 1.—TRACINGS SHOWING PATHOGNOMONIC R-T ANOMALY IN CHEST LEAD AT THE TIME THAT THE CONVENTIONAL LEADS SHOW ONLY INCONCLUSIVE CHANGES

It is not until three days later that the conventional leads begin to show characteristic anomalies, viz, convexity of S-T interval with inversion of T wave in leads 1 and 2. The chest lead taken 11 days after the coronary occlusion occurred shows the R-T interval to have ascended to 1 mm below the isoelectric level.

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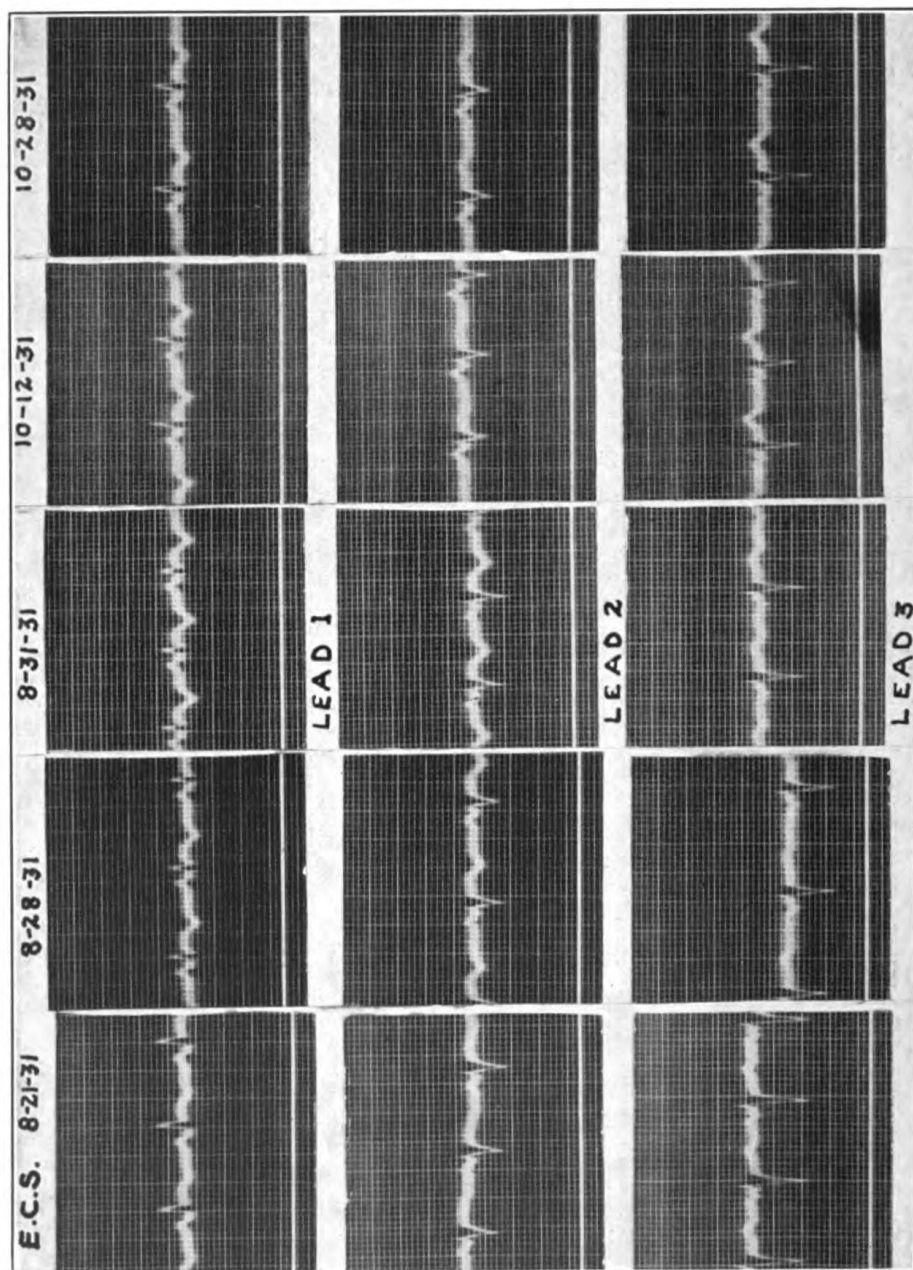


FIGURE 2.—THIS IS AN EXCELLENT EXAMPLE OF THE RAPIDITY OF CHANGE FOUND IN THE FORM OF THE ELECTROCARDIOGRAM DURING THE COURSE OF RECENT CORONARY OCCLUSION  
In no other type of myocardial damage do such radical changes occur in so short a period of time.

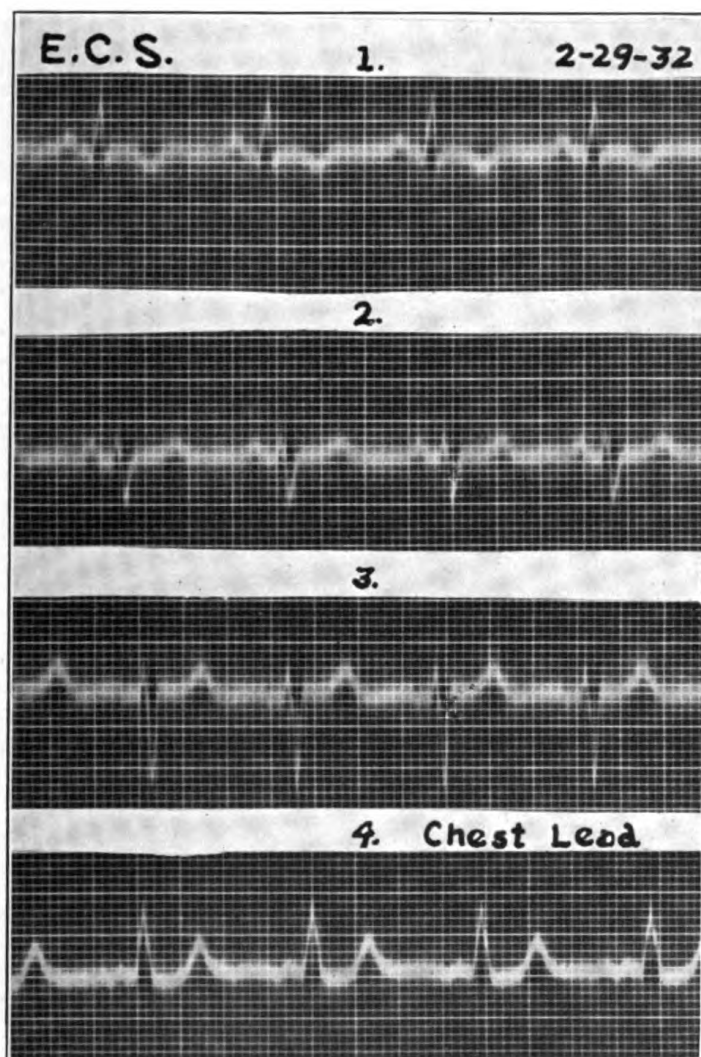


FIGURE 3.—SHOWING CHEST LEAD ANOMALY SIX MONTHS  
AFTER CORONARY OCCLUSION OCCURRED

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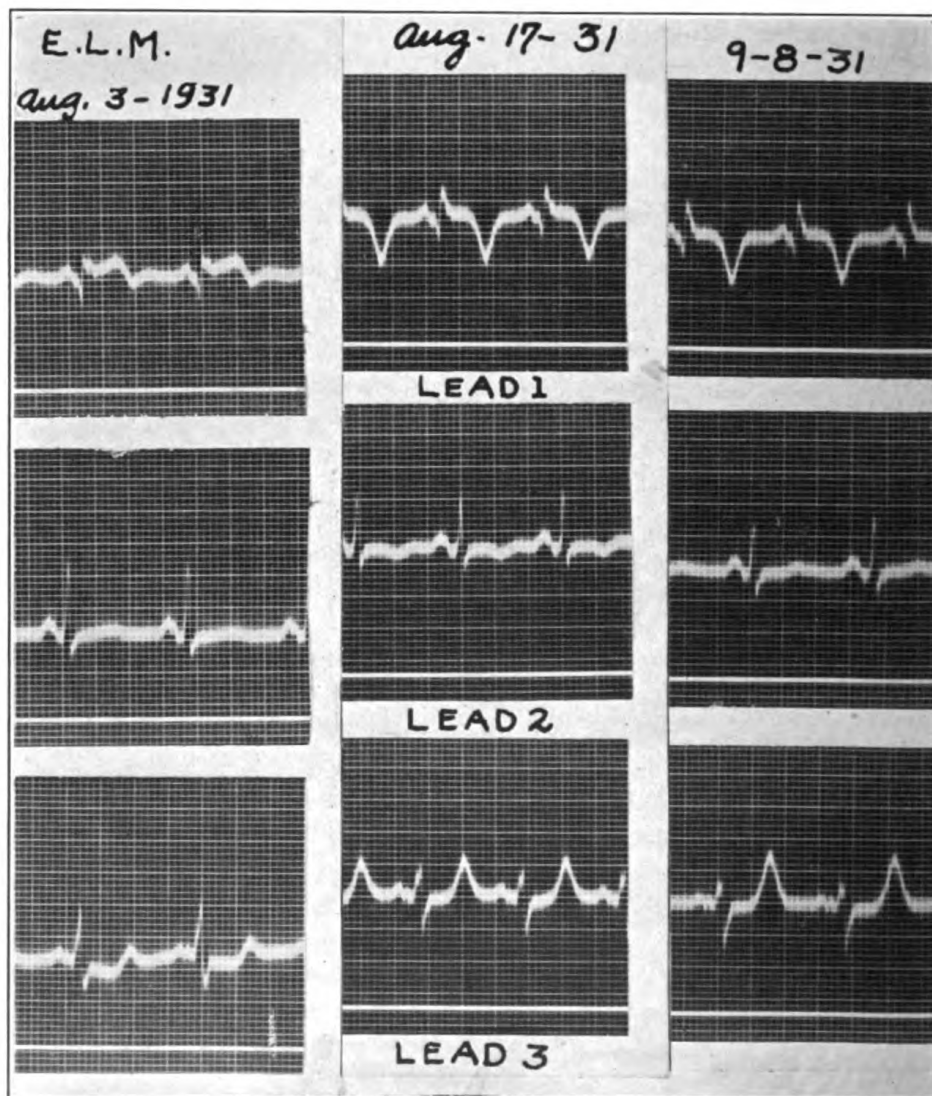


FIGURE 4.—AUGUST 3, 1931. SHOWING HIGH ORIGIN OF T IN LEAD 1 AND LOW ORIGIN IN LEAD 3

September 8, 1931. Showing v shape change in T of lead 1, and disappearance of the lead 3 anomaly.



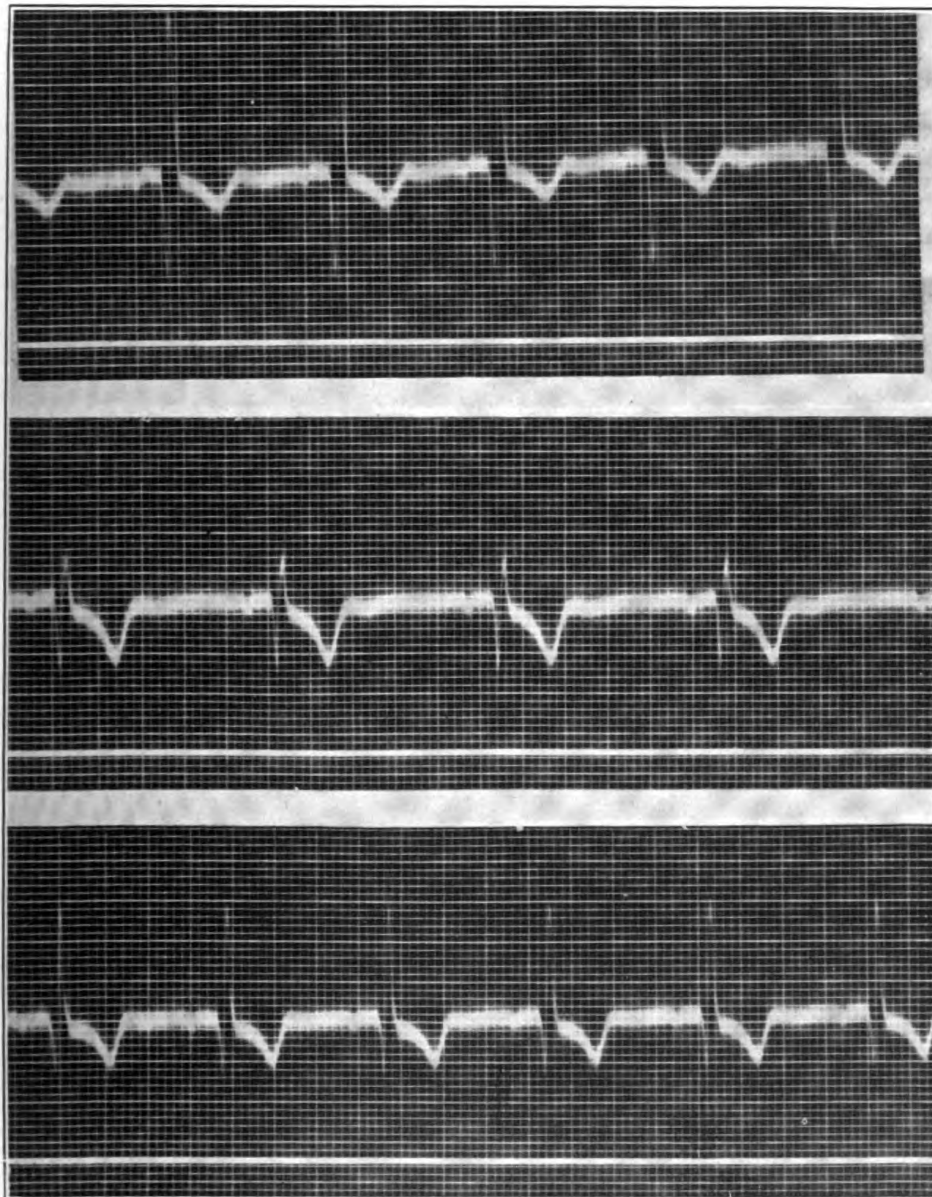


FIGURE 5.—CHEST LEADS FROM THREE YOUNG NORMAL ADULTS TO BE CONTRASTED WITH THE CHEST LEADS OBTAINED AFTER CORONARY OCCLUSION

These normals fulfill all the requirements of Wolferth and Wood for normal chest leads, except that the entire R-T is depressed below the isoelectric level.

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It is unfortunate that in case 1 the patient did not come under observation until four days after the onset of acute clinical signs. It is possible that an earlier date the chest lead would have shown a much more marked anomaly.

This is suggested also by the observation of Wolferth and Wood in their original article that alterations occur early in the chest lead, often before the abnormalities are at all characteristic in the conventional leads, and that they tend to return to normal in relatively short time. Further investigation of the chest lead will undoubtedly prove it a most valuable aid to early diagnosis.

Chest leads taken from normal individuals are shown for comparison. (Figure 5.)

#### CONCLUSIONS

1. The value of the recent contribution of Wolferth and Wood concerning the use of the chest lead as an early diagnostic aid in coronary occlusion is demonstrated.

2. It is emphasized that rapid changes in the form of the R-T complex are practically pathognomonic of recent coronary occlusion,

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#### DIPHTHERIA TOXOID

By H. M. WALKER, Lieutenant (Junior Grade), Medical Corps, United States Navy

Diphtheria toxoid is prepared by treating the toxin with formaldehyde. It contains no serum proteins, is nontoxic, and retains the immunizing or antigenic power of the toxin.

Diphtheria toxoid is recommended for the active immunization of all children from 6 months to 6 years of age and all older children and adults who are not sensitive to toxoid, as may be shown by the reaction test. All individuals who are positive to the reaction test should be immunized with toxin-antitoxin.

The toxoid has many advantages over the toxin-antitoxin. Active immunity can be obtained in a shorter period of time and with more certainty. Two doses of 1 cubic centimeter each, given one month apart, are usually sufficient. Active immunity lasts for years and possibly for life. Unpleasant effects can be more easily prevented when toxoid is used than when toxin-antitoxin is given.

Between the ages of 6 months and 6 years about 70 per cent are Schick positive, while after 10 years of age the percentage may be as low as 15 per cent. Considerable information is available concerning the use of toxoid with children, but only scant data can be obtained regarding its use with adults.

The following results may be of interest to those who may have occasion to immunize adults. On January 12, 1931, 201 healthy, young adult males, of ages ranging from 18 to 35 years, were given the Schick test at the United States naval hospital, Brooklyn, N. Y. (See Table 1.) Of this group 49, or 24.5 per cent, were found to be Schick positive.

January 15, 1931.—The reaction test for diphtheria toxoid was made on the Schick positives. Thirty-four, or 69.4 per cent, were negative, while 15, or 30.6 per cent, were positive, giving mild or severe reactions as determined by the diameter of the erythema following injection intradermally of 0.1 cubic centimeter of toxoid. It was not advisable to give the toxoid injections to this latter group.

January 19, 1931.—Thirty of the thirty-four toxoid-reaction-test negatives were each given 1 cubic centimeter of toxoid subcutaneously. Six, or 20 per cent of this number, had reactions sufficiently severe to keep them in bed. Rise in temperature, severe headache, back-ache, sore and stiff arms were included in these symptoms, which continued for four or five days in each case. Twenty-four, or 80 per cent, had either no reaction or a very mild one. Several sore arms, stiff arms, slight headaches, which did not last long, were included in this group. (A detailed list of symptoms is given in Table 2.)

February 17, 1931.—The second dose of 1 cubic centimeter of toxoid was given subcutaneously. Only 1 of the 30 had a severe reaction. This individual was one of the six who had severe reactions following the first dose of toxoid. He was kept in bed for three days this time. Aside from slight headache and moderate soreness of the arm there was no reaction on the part of any of the others.

March 18, 1931.—The Schick test was repeated on the 30 cases. Only five of these, or 16.7 per cent, were Schick positive, indicating immunization of most cases one month after second dose of toxoid.

May 16, 1931.—The Schick test was repeated. Each individual was Schick negative, indicating 100 per cent immunity three months after second dose of toxoid.

October 4, 1931.—Eight months after the second dose of toxoid all of the original 30 available were found to be Schick negative.

TABLE 1.—*Toxoid administration—Results*

Time.....	Jan. 12, 1931		Jan. 15, 1931		Jan. 19, 1931		Feb. 17.....		Mar. 18, 1931	May 16, 1931	Oct. 4, 1931
Number tested.....	201		49		30		30		30	30	25
Test	Schick test		Reaction test, toxoid		Toxoid, first dose		Toxoid, second dose		1 month	3 months	8 months
					Reactions		Reactions				
Number.....	Posi- tive	Nega- tive	Nega- tive	Posi- tive	Severe	Mild or none	Severe	Mild or none	Immunization		
	49	152	34	15	6	24	1	29	25	30	25
Percentage.....	24.5	75.5	69.4	30.6	20	80	3.3	96.7	83.3	100	100

TABLE 2.—*Symptoms after toxoid administration and other data*

Symptoms	Sore arm	Stiff arm	Ery- thema		Headache	Backache	Sore throat	Temperature increase	In bed	Age			Previous immunity	Schick positive	Reaction test normal	Appear- ance	Duration						
			1-2 inches	More than 2 inches						20 or less	21 to 24	25 to 35					Within 8 to 10 hours	After 10 hours, before 18 hours	8 to 10 hours	18 hours	24 hours	48 hours	4 days
Number.....	29	23	7	20	13	7	4	12	6	11	15	4	5	30	30	26	3	24	21	18	14	4	2

## SUMMARY

1. It was noted that a high percentage of young adults were susceptible to diphtheria, which should be considered when corps men are detailed to attend diphtheria cases.

2. About one-third of these were susceptible to toxoid.

3. Twenty per cent of those negative to the reaction test had severe reactions following the first injection of toxoid, while only one had a severe reaction after the second dose of toxoid. Other reactions were limited to headaches, sore and stiff arms, and backache.

4. Each individual tested was Schick negative within three months after the second dose of toxoid was administered, and remained Schick negative at least eight months afterwards.

5. It is suggested that, as the severe reactions following toxoid injections are not any worse than those following toxin-antitoxin and in consideration of its many advantages, the toxoid should be used in preference to the toxin-antitoxin.



# NAVAL RESERVE

## MEDICAL CORPS

### APPOINTMENTS, FIRST QUARTER, 1932

Name	Rank	Appointed
Amis, James Edward.....	Lieutenant (junior grade), MC-V(G).....	Nov. 30, 1931
Bostic, Sam Crawford.....	do.....	Oct. 12, 1931
d'Alessio, Joseph Anthony.....	do.....	Nov. 27, 1931
Hawes, John Kipp.....	do.....	Dec. 22, 1931
Horton, Arthur Julian.....	do.....	Dec. 31, 1931
Lowe, Frederick Arnold.....	do.....	Nov. 30, 1931
Pearson, Eric Dolph.....	do.....	Jan. 7, 1932
Schulz, Arthur William.....	Lieutenant commander, MC-V(S).....	Dec. 29, 1931
Sugden, John W.....	Lieutenant, MC-V(S).....	Jan. 7, 1932

### PROMOTIONS

Name	From—	To—
Cooper, Howard N.....	Lieutenant (junior grade), MC-F.....	Lieutenant, MC-F.
Green, Joseph S.....	Lieutenant (junior grade), MC-V(G).....	Lieutenant, MC-V(G).
Henderson, James A.....	Commander, MC-F.....	Captain, MC-F.
MacDonald, Francis B.....	Lieutenant (junior grade), MC-V(G).....	Lieutenant, MC-V(G).
Wall, James Hardin.....	do.....	Do.

### TRANSFERS

Brams, William A.....	Lieutenant commander, MC-F.....	Lieutenant commander, MC-V(G).
Collier, Dana M.....	do.....	Do.
Heegler, Fred D.....	Lieutenant (junior grade), MC-F.....	Lieutenant (junior grade), MC-V(G).

## DENTAL CORPS

### APPOINTMENTS FIRST QUARTER, 1932

Name	Rank	Appointed
Gardner, Boyd S.....	Lieutenant commander, DC-V(S).....	Mar. 2, 1932
Hartman, Leroy L.....	do.....	Jan. 4, 1932
Matteson, Harold M.....	Lieutenant (junior grade), DC-V(S).....	Jan. 29, 1932
Miller, Benjamin F.....	Lieutenant (junior grade), DC-V(G).....	Feb. 13, 1932
Petrusich, Stephen C.....	do.....	Mar. 5, 1932
Zonn, Albert H.....	do.....	Feb. 24, 1932





## NOTES AND COMMENTS

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### NEW STANDARD BOOK LIST FOR FISCAL YEAR 1933

Effective July 1, 1932, a new standard list of books will form the supply table list for all Medical Department activities except hospitals. Requisitions from hospitals, as in the past, will not be limited to any particular list.

The new list appears below. Asterisk indicates changes made since the list published in the July, 1931, *BULLETIN*. Requisitions for these new items may now be submitted in order to bring the Medical Department libraries up to the present standard.

The bureau always welcomes suggestions from medical officers as to the desirability of retaining any of these books on the list or of replacing them by others.

- \* Textbook of Anatomy, Cunningham, 6th edition.
- Practical Bacteriology, Blood Work and Animal Parasitology, Stitt, 8th edition.
- Chemistry, Inorganic Pharmaceutical, Rogers, 1930.
- \* Conduction, Infiltration, and General Anesthesia in Dentistry, Nevin and Puterbaugh, 1923.
- Dental Histology and Embryology, Noyes, 4th edition.
- Dental Formulary, Prinz, 4th edition.
- Bacterial Infection, Appleton, 1925.
- Modern Dental Materia Medica, Pharmacology, and Therapeutics, Buckley, 5th edition.
- Dental Pathology and Therapeutics, Buchard and Inglls, 7th edition.
- \* Dental Roentgenology, Ennls, 1931.
- \* Textbook of Exodontia, Winter, 2d edition.
- Dental Dictionary, Ottogy, 1923.
- Operative Dentistry, McGehee, 1930.
- Periodontal Diseases, Merritt, 1930.
- Prosthetic Dentistry, Nichols, 1930.
- Medical Diagnosis for the Student and Practitioner, Greene, 6th edition.
- American Illustrated Medical Dictionary, Dorland, 15th edition.
- Diseases of the Skin, Andrews, 1930.
- Dispensatory, Wood and La Wall, 21st edition.
- Drill Book for Hospital Corps, United States Navy, 1920.
- The Nose, Throat, and Ear, and Their Diseases, Jackson and Coates, 1929.
- \* Food Analysis, Typical Methods and the Interpretation of Results, Woodman, 3d edition.
- Fractures and Dislocations, Speed, 2d edition.
- Urology, Elsendrath and Rolnick, 2d edition.

- \* Gonorrhea in the Male and Female, Pelouze, 2d edition.
- Hospital Corps Handbook, United States Navy, 1930.
- Naval Hygiene, Pryor, 1918.
- Manual of the Medical Department, United States Navy, 1927.
- Medical Compend for Commanders of Naval Vessels, 1923.
- Textbook of Medicine, Cecil, 1930.
- National Formulary, 5th edition.
- Diseases of the Nervous System, Jelliffe and White, 5th edition.
- \* Principles and Practice of Nursing, Harmer, 2d edition.
- Manual of the Diseases of the Eye, May, 13th edition.
- Pharmacopoeia of the United States, 10th edition.
- Practice of Pharmacy, Arny, 3d edition.
- Preventive Medicine and Hygiene, Rosenau, 5th edition.
- Modern Surgery, General and Operative, Da Costa, 10th edition.
- Modern Clinical Syphilology, Stokes, 1926.
- Principles of Therapeutics, Hare, 21st edition.
- Diagnostics and Treatment of Tropical Diseases, Stitt, 5th edition.
- Modern X-ray Technic, Jerman, 1928.

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#### CARBON MONOXIDE FROM PAINT IN SEALED COMPARTMENTS

Writing in the December, 1931, number of the Journal of Industrial Hygiene, J. S. Dudding, S. F. Dudley, and R. C. Frederick, Royal Naval Medical School, Greenwich, report the results of a chemical and biological investigation of the air in "blisters" and other sealed spaces of ships.

The investigation was the outcome of the death of a man who entered a bulge (blister) of a battle cruiser before it was properly ventilated, as required by the admiralty orders. Death was at first attributed to carbon monoxide, but no trace of this gas was found in the blood collected at post-mortem.

In commenting on deaths of this nature, they state:

\* \* \* Sometimes these disasters have been attributed to poisoning with carbon monoxide, but in the majority of instances where the case has been properly investigated no trace of carbon monoxide has been found in the victim's blood. The cause of death is generally due to acute asphyxiation—the man being "drowned" in an atmosphere deficient in oxygen. One cause of the erroneous diagnosis of carbon-monoxide poisoning, which is so often at first suggested, is that the skin in such cases of acute asphyxiation often retains its pink color, which, in a corpse, simulates the pink complexion characteristic of carbon-monoxide poisoning.

Chemical analysis of the air in blisters and other sealed places, according to this report, showed:

\* \* \* that the atmosphere of such spaces might contain less than 2 per cent of oxygen without any proportional rise in the carbon dioxide content. The absorption of oxygen by the linseed oil in the paint used in sealed compartments was, however, an old observation, but the surprising discovery was made that the gas in such a space might contain as much as 0.2 per cent

of carbon monoxide. Experiments were made to determine the origin of this carbon monoxide. Iron oxide paint, such as is used in ships' bulges, was stored in sealed glass bottles for various periods. Chemical analyses showed percentages of carbon monoxide ranging from 0.08 to 0.27. The constituent of the paint which was responsible for this gas was the boiled linseed oil. In one experiment the gas in the drum which had contained boiled linseed oil and which had remained sealed for five months contained 0.21 per cent of oxygen, 3.28 per cent of carbon dioxide, and 0.35 per cent of carbon monoxide. Thus there was actually more carbon monoxide than oxygen in this atmosphere.

In their interesting commentary, which is quoted below in full, the authors discuss the two instances of carbon-monoxide poisoning, both occurring in a "blister of a battleship in the United States Navy," which were reported in the January, 1931, number of the *NAVAL MEDICAL BULLETIN*.

The sequence of events described in this report is interesting, because a preliminary but erroneous diagnosis of death from carbon-monoxide poisoning, which was really due to acute anoxemia, started an investigation which proved that carbon monoxide was formed from paint in sealed compartments. However, the air from such compartments as were examined contained carbon monoxide in dangerous quantities only when the amount of oxygen present was too small to support life. Therefore, at first sight, it appeared that detection of carbon monoxide in these confined spaces, though of academic interest, was of little practical import, because a man entering them would always be asphyxiated long before he had time to be poisoned by any carbon monoxide present. However, two facts put one on guard against accepting this conclusion as a general rule. First, it was noticed that there was no constant inverse relation between the amount of oxygen and carbon monoxide in these analyses, either of the air samples of the actual spaces themselves or of the artificial "paint extracted" atmosphere. Secondly, in the "artificial" atmosphere mice were able to survive three or four hours before dying, and since their blood after death was 80 per cent saturated with carbon monoxide, they undoubtedly died from this cause. (The latter circumstance is still significant in spite of the fact that it is probable that small animals like mice can survive in a lower percentage of oxygen than animals as large as men.) If it should be possible for the air in confined spaces to remain respirable, and yet contain a dangerous concentration of carbon monoxide, then these observations become of practical importance. For instance, such a space may be considered safe because it will support the combustion of a safety lamp, whereas in reality there is present a lethal concentration of carbon monoxide.

This inference has received startling confirmation from a recent report of two disasters in the United States Navy.<sup>1</sup> In the first disaster three men were overcome after working in a blister of the U. S. S. *Nevada* for 1½ hours. In this case there is no question but that carbon-monoxide poisoning was the correct diagnosis. The victims in the *Nevada* had been using an oxyacetylene torch, and the carbon monoxide which was subsequently found by analysis of the air of the compartment was suggested to have been produced by the incomplete combustion of the acetylene, but if the oxygen was turned on during the use of this torch the foregoing hypothesis becomes unconvincing. In the second disaster, in the U. S. S. *New York*, nine men entered an un-

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<sup>1</sup> Carbon Monoxide Poisoning. United States Naval Medical Bulletin, 1931, 29, 172.

ventilated bilge; all were affected within a few minutes with symptoms which, in those that survived, were more consistent with carbon-monoxide poisoning than with oxygen deficiency, and carbon monoxide is reported to have been found in the blood of the two fatal cases. In the *New York* accident the length of time that the victims were exposed to the dangerous atmosphere is unstated. The description of the event shows that at first attempts were made to get the men out without antigas apparatus; secondly, a smoke helmet was used and discarded; thirdly, another form of apparatus failed; and finally a mask and air hose were "secured from the navy-yard fire department." Therefore we think it fair to surmise that the abortive attempts at rescue must have occupied at least half an hour before the men were got out of the blister. The length of exposure, combined with the fact that seven out of the nine men ultimately recovered, again suggests that carbon monoxide was the cause of the fatalities. The effects of a lowered oxygen tension would also augment the action of any carbon monoxide present, and accelerate the appearance of symptoms. The United State reporter can suggest no source of origin for the carbon monoxide in the *New York's* blister. These American disasters combined with the present investigation leave little reasonable doubt that under unknown conditions the action of paint in confined spaces can produce a lethal concentration of carbon monoxide and at the same time leave enough oxygen to support respiration—at least for short periods.

Although on previous occasions carbon monoxide has been reported as a product of drying paint fumes, some chemists have not been satisfied that the technic used to demonstrate its presence was altogether above suspicion. In this instance, it is believed for the first time, a chemical analysis has been independently confirmed by biologic experiments. Moreover, the use of the Hart-ridge reversion spectroscope for the blood examinations excludes the possibility of mistaking such compounds as oxyhemoglobin and nitric-oxide hemoglobin for carbon-monoxide hemoglobin—mistakes which are sometimes made, by the unwary and inexperienced, when an ordinary spectroscope is employed.

Finally, from the practical hygienic point of view, it would seem that the evolution of carbon monoxide from paint is too slow and the quantity too small to produce acute or chronic symptoms in any environment other than a hermetically sealed compartment. In this respect the type of poisoning described above presents an interesting analogy to the chronic arseniuretted hydrogen poisoning which was reported in certain submarines which had to do prolonged diving during the war.<sup>2</sup> It is improbable that the traces of arsine, which were produced from impure grids of secondary batteries, any more than the traces of carbon monoxide produced by paint, could ever accumulate in sufficient quantity to cause symptoms except in "sealed" compartments.

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#### TREATMENT AND PREVENTION OF HEAT CRAMPS

The December, 1931, number of the *Journal of Industrial Hygiene* contains an article by Dr. D. M. Glover, on the treatment and prevention of heat cramps in industry by means of sodium chloride.

The clinical and experimental evidence reviewed, according to the author, tends to show that the loss of large amounts of salt in the sweat is the chief etiologic factor in the production of cramps.

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<sup>2</sup> Dudley, S. F., Toxemic Anemia from Arseniuretted Hydrogen Gas in Submarines. *J. Indust. Hyg.*, 1919-20, 1, 215.

The results obtained from treating cramps among the employees of the Otis Steel Co. and the United States Aluminum Co., in Cleveland, by giving them salt solution were so convincing that it led to popularizing the idea of adding salt to the water drunk by the workers.

After trying various methods of furnishing a definite amount of sodium chloride, tablet-dispensing machines were installed on the wall immediately above the drinking fountains, with appropriate signs, reminding the men to take a salt tablet every time they took a drink. At first, 10-grain sodium chloride tablets were used, but this amount was later increased to 16 grains.

As to the results obtained, the author states:

The most convincing evidence we can produce is that cramps, which were common before, have practically disappeared since the introduction of the use of salt prophylactically. Furthermore, plant superintendents have been almost unanimous in their observation that during the hot months their men are able to work more steadily and to produce more when they are taking salt regularly. These observations are, of course, subject to error. The workers have cooperated surprisingly well with the plan, and the more intelligent ones who have worked for many years in the steel mills are enthusiastic users of salt. The men have repeatedly told us that when they take salt regularly they do not become so thirsty, they do not have cramps, and they are less liable to have the minor symptoms of fatigue and heat exhaustion. The enthusiasm of some of the men, however, must be literally "taken with a grain of salt," because they are inclined to take one of the salt tablets for constipation or any other ailment.

There will always be a few men who do not follow the rules, and among this group there will always be a few cases of cramps. In plants where salt is being used, however, a man who has not been taking the tablets regularly will usually take some at once if he begins to have cramps and will be saved from the severe spasms. The taking of salt at this stage, however, will not prevent the cramps entirely.

In a plant with from 1,000 to 1,800 employees, where heat cramps had previously been very common, after the introduction of salt prophylaxis there was no time lost from this cause during the years 1928, 1929, and 1930. In a steel mill employing from 3,000 to 3,500 men there were 48 days lost from heat cramps in the summer of 1927. After the use of salt tablets was begun the number of days lost dropped to nine in 1928, to four in 1929, and to none in 1930 (production was also considerably curtailed in 1930). In none of the cases in which time was lost had the men taken salt tablets. In fact, we have not had a single case of cramps among the men who have taken salt regularly.

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#### PRESENT-DAY PROBLEMS OF YELLOW FEVER

The United States Public Health Service has recently pointed out that except in reminiscence the average physician rarely gives a thought to yellow fever. No doubt some believe that the disease has been almost eradicated and that it will soon disappear from the entire world, but it is by no means near extinction. There is a vast reser-

voir of yellow fever in west Africa, the disease still persists in certain parts of Brazil, and in 1929 it reappeared in Colombia. It is not only possible but extremely probable that, on account of increased and more rapid means of intercommunication, particularly increase in travel by airplane, yellow fever will reappear in many former endemic centers and even spread to countries never before infected, unless the strictest vigilance is maintained to prevent it.

The virus of yellow fever remains undiscovered. This unknown but living entity, when first it gains access to the blood of human beings, produces yellow fever in most adults, often resulting in death. However, in children, and also in many adults, the virus of yellow fever may be present and complete its life cycle in the body without producing recognizable manifestations of its presence. This fact gives rise to large numbers of "missed" or unrecognized cases of the disease.

Until recently it was believed that a single mosquito (*Aedes aegypti* variety) was alone responsible for the transmission of yellow fever and that in the absence of this species, which does not breed in ground water, the disease could not be propagated. Then, too, it was frequently believed that this insect would not fly more than about 200 yards. We are now told that there are 13 species of mosquitoes that can convey yellow fever, and that *Aedes aegypti* will travel from 400 to 1,000 yards; that, under laboratory conditions, the virus of yellow fever may be passed from one mosquito to another; and that some of the newly discovered vectors breed in ground water.

Certain species of monkeys develop yellow fever when bitten by infected mosquitoes, and laboratory cases have occurred in human beings in which infection by mosquitoes could, apparently, be entirely excluded, suggesting infection by contact.

Efforts are still being made to immunize against yellow fever with, as yet, varying and unsatisfactory results.

It is hardly possible at this time to evaluate our newer knowledge of yellow fever or to express it in terms of prophylaxis and control. However, it is not believed that yellow fever is ordinarily contagious; and it is doubtful whether the transmission of the disease from mosquito to mosquito is an important factor in rapidly propagating the disease, though possibly it may be in maintaining its existence. It is still a question whether insects which breed in ground water are a serious epidemiological factor on this continent; but we can not ignore them. It seems most probable that the susceptible human (or animal) host is a necessary link in the continued existence of yellow fever in spite of the apparent demonstration of the infection of one mosquito by another.

To sum up the effect which this newer knowledge of yellow fever may have in combating the disease, it may be said that, while these

new discoveries enable us to combat yellow fever more effectively they reveal to us the fact that our goal of complete extermination is, apparently, a far more formidable task than we were led to believe a few years ago.

The prevention of the spread of yellow fever and its eradication can no longer be regarded as the individual affair of the nation in whose territory the disease exists; it is a matter of interest to the entire world. The presence of yellow fever in one country is the immediate concern of all countries within striking distance of the disease and, for humanitarian reasons, the collective concern of all civilized nations. There must be no retrogression nor relaxation of effort in the struggle to control, and eventually to exterminate, this dangerous disease. On the contrary, there should be a forward, a continuous, a persistent attack on every lurking focus until yellow fever is annihilated, even though it should require decades of effort to accomplish this result.

So long, however, as yellow fever remains in the territory of any country, other nations with infectible territory must necessarily exercise the right to quarantine against those places where the disease exists. Quarantine measures which afford full protection to-day may be found to be wholly inadequate to-morrow, depending on the appearance of new foci and the development of new and more rapid facilities for intercommunication. The necessity for quarantine measures against yellow fever increases with proximity to the focus of infection, with the extent of the infection, and with rapidity of travel. Ports and places in many parts of the world that were formerly weeks apart by ordinary means of communication are now within a few days of each other by airplane.

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#### MOSQUITOES TRANSPORTED BY AIRPLANES

In the United States Public Health Service weekly report of November 30, 1931, T. H. D. Griffiths and J. J. Griffiths report the results of an inspection for mosquitoes of all airplanes from tropical ports arriving at the airports of the Pan American Airways System at Miami, Fla. The inspection covered the period from July 23 to September 28, 1931.

The paper includes experiments with stained specimens of *Aedes aegypti* placed on planes at San Juan, P. R., destined for Miami, and gives the staining method used in determining mosquito importation.

Officials of the Pan American Airways System readily and fully cooperated with the United States Public Health Service in the undertaking. Three types of planes were in use during the period of

inspection; namely, trimotor Fokkers, Sikorsky amphibians, and Commodores.

The summary of the report and the conclusions reached by the authors follow:

(1) Of the three types of passenger-carrying airplanes now operating round trips between Miami, Fla., and the West Indies, western coast of South America, Central America, Panama, Mexico, and Jamaica, the Commodore is physically best suited for carrying mosquitoes in the cabin; but, due to regular spraying with an insecticide or to lack of mosquito prevalence at ports of departure, or call, no mosquitoes were found aboard these ships. The front baggage compartment of the Sikorsky amphibian is ideal for harboring mosquitoes. A large majority of the mosquitoes not intentionally placed on planes, in experimental work, were found in this compartment.

(2) One hundred and two inspections of airplanes arriving at Miami from foreign and insular airports were made from July 23 to September 12, 1931, and of this number 21, or 20.5 per cent, carried mosquitoes. In all, 29 mosquitoes were captured, 24 of which were taken on Sikorsky amphibian planes. Of these mosquitoes 28 were *Culex* and one was *Aedes aegypti*.

(3) *Aedes aegypti* (with a few *Culex quinquefasciatus*) numbering approximately 100, were developed from collected larvæ and pupæ, stained with a 2 per cent watery solution of yellowish eosin by means of an atomizer, then liberated on planes leaving San Juan, P. R., on September 13, 16, and 18, 1931. Of the 100 specimens put aboard on these three dates, 22 specimens were recovered at Miami, Fla., 1,250 miles distant, on the afternoons of the days of departure. The average time of these air trips was 10 hours and 10 minutes, 1 hour and 10 minutes of which were spent at intermediate landing fields. Eleven of the 22 recovered specimens showed strongly positive reactions to the stain solvent. The fact that not a single mosquito had been caught on the trimotor Fokker planes arriving at Miami from San Juan from July 23 through September 12, and that 13 were caught on September 13, 3 on the 16th, and 6 on the 18th, the only dates when mosquitoes were placed aboard, is strong enough evidence of their coming through even though only 50 per cent of them reacted to the stain solvent (glycerine 4 parts, absolute alcohol 4 parts, ether 1 part) after being recaptured.

(4) One mosquito was observed biting during flight of the plane on September 16, 1931, and at approximately 3,000 feet altitude over Dominican mountains.

#### CONCLUSIONS

That certain types of airplanes carry mosquitoes (particularly *Aedes aegypti* and *Culex quinquefasciatus*) has been proved. With conditions at airports such as would permit of many mosquitoes getting aboard, it might be expected that approximately one-fifth of the original number would be transported for a long distance—at least 1,250 miles—in one day, with repeated landing and the opening of doors, hatches, and windows, and refueling, unloading, and loading taking place. Under average natural mosquito production conditions about airports, heavy infestation of aircraft (like the "loading" of planes in these experiments) would not be expected and, consequently, mosquitoes in only small numbers would make the trip. However, even one infected, or infective, *Aedes aegypti* might be the means of starting an epidemic. Notwithstanding the fact that airplanes may, or do, transport mosquitoes, this mode of introduction of mosquito-borne disease is probably secondary in importance to the importation of infected man.



With the relatively small number of mosquitoes carried by aircraft and the facility with which airplanes may be freed from mosquitoes at ports of departure, it may safely be concluded that, while there is a recognized potential danger, there is no obstacle to the efficient treatment of airplanes so as to destroy mosquitoes and avoid retardation of air traffic progress.

#### DUODENAL ULCER

The *Lancet*, of February 13, 1932, contains the Hunterian lecture, *The Natural History of Duodenal Ulcer*, delivered before the Royal College of Surgeons of England by Dr. John A. Ryle, physician to Guy's Hospital.

In introducing the subject, he states, among other things, that:

\* \* \* Duodenal ulcer is a prevalent disease, and there is evidence (although due allowance must be made for growth and concentration of population and for improvements in diagnosis) that this prevalence waxes rather than wanes under the existing conditions of civilized life.

An inquiry into the admission rates of some common diseases at Guy's Hospital shows that, on the average, 100 cases of duodenal ulcer are admitted annually—that is to say, about 1 per cent of all admissions—a figure somewhat less than the admission rate for tuberculosis (all forms) but greater than that for all the pleurisies and lobar pneumonias combined. In addition, large numbers of cases are treated in the out-patient department. In my private practice, which has a general character—albeit with an abdominal bias—the 10 most frequent diagnoses are duodenal ulcer, anxiety state, constipation, cholecystitis and gallstones, hyperpiesia (with its cardiac and neurological sequels), tuberculosis, anæmia (all forms), migraine, spastic colon, and obesity. Of these, duodenal ulcer heads the list, accounting for approximately 5 per cent of all my cases.

\* \* \* Dividing the period 1910–1929 into four 5-year periods the admission rates for perforated duodenal ulcer (Guy's Hospital) are as follows:

	Cases
1910–1914.....	48
1915–1919 (war period).....	29
1920–1924.....	87
1925–1929.....	115

A part of this increase may be due to the fact that surgeons have come to observe a better precision in locating ulcers with reference to the pyloric sphincter. The annual total of deaths from duodenal ulcer in England and Wales has almost doubled in the last decade \* \* \*. It seems doubtful whether this increase can be wholly accounted for by such factors as growth of population, improved recognition, and better habits of precision in recording the site of the ulcer. Moreover, the deaths from gastric ulcer have shown a contemporary and parallel rise. In both cases the increase is much more conspicuous in the males.

Although the mortality of its most serious complication has been remarkably diminished by surgery, duodenal ulcer continues to take its toll and remains, through painful dyspepsia and occasional hemorrhage, a serious cause of disability and lost efficiency among members and classes of the community often endowed with energy and usefulness above the average and sometimes with outstanding ability.

Although of all the dyspeptic disorders duodenal ulcer presents the most clear-cut clinical picture, its leading characters and natural behavior are not so widely appreciated in the profession as they might be.

Thus the length of time elapsing between first appearance of symptoms and diagnosis is usually to be reckoned in years rather than months. \* \* \* Among 121 cases (excluding cases of pyloric stenosis) in which the length of time between first symptoms and diagnosis could be roughly computed (all cases diagnosed in less than one year being counted as "immediate") the average interval was seven years.

Duodenal ulcer has supplied us with a number of problems in etiology, prognosis, and treatment which are at present only partially solved.

Doubts and difficulties continue to confront us. The wavering from medical to surgical and back to medical opinion and the continued invention of new treatments and operations are eloquent of our uncertainty. Extravagant claims have been made from time to time by protagonists of both the medical and surgical schools. Bacteriology, biochemistry, minute anatomy, and statistical inquiry have, severally and collectively, failed to give the whole answer to our question. We have reached a point at which therapeutic experiment and specialized studies seem no more competent to give help in practice than a general survey of the active disease as it occurs and as it varies in living man. \* \* \*

After a broad and interesting review, Doctor Ryle concludes that :

\* \* \* What we chiefly need in practice to-day is some surer guidance in the grouping and management of cases. My present policy, based on experience, of which I have here given a partial account is, to advise gastrojejunostomy in cases of pyloric stenosis; in cases of long-standing duodenal ulcer in which clinical history, X rays, and test meal proclaim gross scarring or anchorage and a tendency to slow transit of food without serious stasis, and in which there has been recurrence in spite of one or more strict courses of medical treatment; in cases presenting the syndrome of anchorage to or erosion of the pancreas; and in cases of concomitant duodenal ulcer and duodenal ileus, where, again, there is an obstructive factor at work obviating sound healing by mechanical unrest and increasing the likelihood of perforation by increased intra-duodenal pressure \* \* \*. My policy is to oppose surgical treatment in youthful cases; in nonobstructive cases with short histories and adverse pedigrees or not previously accorded a strict medical treatment; in cases with recent hemorrhage, lacking other indications; and in cases in which X ray and test meal show gastric "hurry," for here to accelerate emptying still further and to attempt an anastomosis in the presence of exaggerated motor and chemical unrest is to create just those conditions which may be held to favor secondary ulceration. Highly nervous individuals and elderly subjects should often be deemed unsuitable for surgery, even when the only alternative in continuous medical and dietary care. Economic and environmental factors must at times compel a modification of general policy. Surgical treatment should always be followed by a period of strict medical treatment and proper precautions thereafter. Psychological as well as physical requirements must be carefully studied.

All surgeons and physicians who undertake the treatment of this troublesome disease must endeavor to preserve the studious attitude, not lightly accepting opinion or submitting to the bias of their craft, and remembering always that they are not, in fact, concerned with duodenal ulcer the lesion, but with duodenal ulcer the disease, as it occurs and as it varies in individuals of special type and temper and differing daily circumstance. In each case, briefly, judgment must be based not upon the presence of an ulcer but upon a proper understanding of the whole patient and the whole disease.

As I have sought to show, duodenal ulcer has general effects on the body and the mind as well as general causes in them, and no effect or cause can be neglected.

In a restless and fretful age which has largely lost the old simplicities of diet and conduct the most important contribution which we can make to the prophylaxis of duodenal ulcer is to furnish, as opportunity arises, sensible instructions to the community (and particularly to such families or individuals as manifest a constitutional or occupational predisposition to the disease) with regard to the evils of missed and bolted meals, of excessive smoking, and of the prevalent habit of attempting to combine the process of digestion with anxiety and affairs. It is not extravagant to suppose that a cup of hot milk at 11 a. m. and bedtime would save many a harassed doctor or business man endowed with the diathesis from developing the disease.

The most important contribution which we can make to the therapeutics of duodenal ulcer is, by observing subjective symptoms, to insure much earlier diagnosis, and, by observing the entire disease and the qualities of its victims, to achieve a wiser balance in our choice of method.

It is, I believe, a just criticism of surgery and medicine in the present era that they have concentrated on parts to the exclusion of the whole and on technique to the exclusion of philosophy. In duodenal ulcer no less than in many other maladies, we have come to rely upon too narrow a pathology. In our therapeutic quests we have been too little observant of physiological principle. We are all compelled by the magnitude of our subject to be something of specialists, but this should not necessitate an abandonment of that naturalistic outlook which marked the achievement of our old preceptors from Hippocrates to Hunter.

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#### GASTRIC MUCIN IN TREATMENT OF PEPTIC ULCER

Arthur J. Atkinson, Chicago (Journal of American Medical Association, April 2, 1932), treated 43 patients with history, signs, symptoms, laboratory evidence, and Röntgen manifestations of peptic ulcer with mucin. The patients were chosen because all the evidence concurred in the diagnosis. The therapeutic dosage of mucin totaled 90 grams a day, but three patients received as much as from 150 to 238 grams a day in a study of the effect on the gastric acidity. Ewald, fractional and motor test meals were given, and the stools examined for occult blood. The "acid test" as suggested by Palmer was used at first and later modified to coincide with Hardy's technic. The 43 patients in the series became symptom free within an average period of 1.7 days. The types of ulcers treated in the series are tabulated. The average duration of ulcer history, which was 5.2 years, indicates the marked chronicity of the ulcer diathesis in this group. Eighteen of the patients were awakened by pain suggesting gastric retention or continued secretion. Thirty-five of the patients in the series had previous medical management, spending a total of 208 weeks in hospitals, an average of 5.9 weeks per patient. All obtained relief on mucin with a total of 25 weeks of hospitalization, an average of 0.71 week per patient. Fifteen, having distress while on

medical management when first seen, were continued ambulatory and obtained complete relief with mucin. Although any form of therapy may bring about a remission, there is no doubt that remarkable results have been obtained in patients who were previously having distress on dietary or alkali management. The time of observation has been too short to prove that the improvement is permanent in a disease in which the natural history is so variable. The author feels fully justified in believing that mucin treatment is conducive to healing.

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#### DIABETIC COMA

In the January, 1932, number of the Medical Clinics of North America, Drs. E. P. Joslin, H. F. Root, P. White, W. R. Jordan, and H. M. Hunt report an analysis of 179 instances of diabetic coma in 154 individuals with particular reference to the results of treatment without alkalies. Their interesting and instructive conclusions are quoted here in full.

1. The records of 179 cases of coma in 154 diabetics with 27 deaths are analyzed. Since discharge from the hospital during the last eight years only 17 more cases have died. The remaining 110 have been traced to June, 1931.

2. The mortality in coma increased with age from 0 in 8 cases in the first decade, 4.3 per cent in 70 cases in the second decade to 45.4 per cent in 22 cases in the sixth decade. However, but 1 death occurred in 4 cases in the eighth decade. Two cases died on account of less energetic treatment than we now use; 5 deaths unexplained, 11 deaths with complications during coma, 9 deaths with complications subsequent to recovery from coma.

3. Insulin dosage during the first 24 hours has risen from 183 in the last series to 252 units in this, partly due to the greater severity of the coma as shown by the greater reduction in the plasma bicarbonate. Nine cases received between 560 and 1,020 units with two deaths. One child recovered with 32 units, another boy required 840 units.

4. Two-thirds of the cases were females.

5. In August, September, and October occurred 66 of the 179 cases.

6. Twenty-three per cent of the cases occurred within the first year after onset of diabetes and 65 per cent during the first four years. In 11 cases the diagnosis of diabetes was not made before the onset of coma.

7. Fatal circulatory collapse occurred in five cases in whom coma had been unrecognized and treatment delayed until they were moribund.

8. Recoveries occurred with blood sugars of 1.62 per cent in one case and plasma CO<sub>2</sub> as low as 2 volumes per cent in another.

9. Sixty-nine of seventy children recovered from coma.

10. Differential diagnosis of coma is summarized. An important test for the physician in an emergency consists of examining two consecutive specimens of urine, the bladder being emptied by catheter to obtain the first. In coma the second specimen will contain sugar and diacetic acid, whereas in insulin shock it will be sugar free.

11. The blood lipids in 34 cases are reported. Lipemia was found in 24 cases. In 10 instances the blood cholesterol was below 300 milligram per cent.

12. At discharge from the hospital in 1931 the diets contained an average of carbohydrate, 141 grams; protein, 65 grams; and fat, 84 grams.

#### CARBARSONE IN TREATMENT OF AMEBIASIS

According to A. C. Reed, H. H. Anderson, N. A. David and C. D. Leake, San Francisco (Journal of American Medical Association, January 16, 1932), the drugs so far suggested for the therapy of amebiasis may be classified as follows: (a) Alkaloids, such as those of ipecac or kurchi; (b) oxyquinoline derivatives, such as chiniofon ("yatren"); (c) organic arsenicals, such as acetarsone ("Stovarsol"), and (d) miscellaneous antiseptics and astringents, such as the alkyl resorcinols and bismuth compounds. These types of amebicidal agents have been critically evaluated on the basis both of laboratory and of clinical studies. Emetine, the most commonly used drug in amebiasis, is only partially effective in doses which too often are dangerous, especially to the heart, and there seems to be little hope of finding among the ipecac alkaloids a drug meeting the requirements for satisfactory therapy in this disease. The kurchi alkaloids have little if any useful effectiveness. Critical data are not yet available to judge properly of the value of the alkyl resorcinols, although they are interesting. It is indicated that more satisfactory amebicides are to be found among the oxyquinoline derivatives than chiniofon, the only one so far exploited; but since systematic investigation of this group has scarcely begun, conclusions can not be drawn at the present. Certainly chiniofon has not been as successful as was hoped it would be. Of the organic arsenicals, only acetarsone has been much used in amebiasis, but experience shows that it is only slightly effective and then at doses too often dangerous. With rigorous but arbitrary clinical criteria of "cure," the authors treated 40 unselected amebiasis patients with a high degree of success by "carbarsone," a drug, 4-carbamino-phenyl arsonic acid, containing 28.8 per cent of arsenic. The recommended dosage is 75 milligrams per kilogram in divided amounts over at least a 10-day period, since the arsenic in the compound seems rather slowly absorbed and eliminated after oral administration. Practically, this dosage amounts in the average adult to 0.25 gram twice daily for 10 days, given in gelatin capsules by mouth. It should not be used in amebic hepatitis, or in amounts which might cause symptoms of arsenic toxicity. More closely than any other drug now exploited does carbarsone meet the requirement of an ideal antiamebic agent. It is clinically nontoxic in effective doses; it

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may conveniently be administered orally without interference with the patient's usual routine; it has no untoward side actions, and it is comparatively cheap. There is no evidence as yet that it may be of prophylactic value.

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#### THE PREVENTION AND CONTROL OF VENEREAL DISEASES

A report of considerable interest recently submitted to Congress by Surgeon General H. S. Cumming deals with the prevention and control of the venereal diseases. During the fiscal year recently ended, the State health officers of 43 States reported to the Public Health Service slightly more than a quarter of a million cases of syphilis and more than 150,000 cases of gonorrhea. These diseases as a class continued to exceed the number of cases reported during the year of any other single communicable disease with the exception of measles.

The malaria treatment of general paralysis of the insane is now generally considered the most effective treatment of this condition. As a result the Public Health Service receives each year an increasing number of requests for infected mosquitoes for inoculation purposes. Plans are now under way to supply this need and to make further studies of this method of treatment in cooperation with various institutions where it is being applied.

Increasing importance is being attached to the early diagnosis and treatment of syphilis. The possibility of extending to rural and remote districts the advantages to be derived from early diagnosis by means of microscopic examination were studied and one method was worked out. This method has been tested by other observers and at present is in operation by one State health department and is under consideration by others.

A special study of syphilis among negroes in rural areas in cooperation with State and local health authorities, inaugurated in 1929 with the financial assistance of the Julius Rosenwald Fund, was extended to include areas in five other States. A total of 28,195 negroes were serologically tested, and of this number 5,785, or 20.5 per cent, were found syphilitic on the primary survey. Of these positive cases, approximately 75 per cent were placed on intravenous medication, and at the close of the year 45 per cent of them had received treatment in amount considered sufficient to render them non-infectious. It is unfortunate that the methods used can not be applied to all classes of population.

A 1-day census of the cases of venereal diseases taken in three cities shows marked variation in the relative incidence and prevalence of these diseases as observed in different localities. A resurvey of

one entire State and of a number of communities originally studied in 1927, made in order to determine the trend of venereal diseases and the effect of the methods employed for their control during the 3-year period, disclosed the significant point that in communities where increases in the prevalence rates were found they occurred in the group of chronic cases, an indication that patients are being treated for a longer time than formerly.

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**INFECTIONS IN GENITO-URINARY TRACT, AND COMPLICATIONS: FURTHER  
ADVANCES IN TREATMENT**

Hugh H. Young, J. A. C. Colston, and J. H. Hill, Baltimore (Journal of American Medical Association, February 27, 1932), state that the bacteriology of the urinary tract shows an extremely varied flora and organisms of a wide range of virulence and susceptibility to anti-septics. *B. coli* is inhibited by 1:500,000 mercuric chloride, whereas *B. lactis-aerogenes* is not inhibited until the strength of chloride in the broth culture reaches 1:30,000. The alkalizing bacteria are best combated by acids. The great difficulty of eradicating infections of the genito-urinary tract is due to the fact that the bacteria have usually penetrated deeply into the tissues and glands beyond the urinary passages. On this account, injections and irrigations frequently fail to eradicate the infection. The use of chemotherapy and protein therapy have been shown to be of distinct value. A series of complicated gonococcus infections, the cure of which was greatly hastened by the use of intravenous mercurochrome, is cited as well as the failures. Gram-positive coccus infections of the kidneys and bladder are shown by a series of cases to have been eradicated by intravenous injections of neoarsphenamine. Bacillary infections of the urinary tract, particularly the aerobacter group, have been shown to be especially resistant, but cases that have responded favorably to intravenous injections of mercurochrome are cited. Septicemias of urinary origin and cases of sepsis without blood stream infection are shown in some instances to be much benefited by chemotherapy. The authors reassert their confidence in the great advisability of supplementing local injections and irrigations in urinary infections with intravenous therapy.

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**RHEUMATOID (INFECTIOUS) ARTHRITIS AND ACUTE RHEUMATIC FEVER:  
DIFFERENTIAL DIAGNOSIS**

In 17 patients with rheumatoid (infectious) arthritis on whom A. M. Master and Harry Jaffe, New York (Journal of American Medical Association, March 12, 1932), took electrocardiograms daily

for an average of 53 days, only the slightest evidence of myocardial involvement was recorded. In 63 cases of acute rheumatic fever, definite electrocardiographic evidence of myocardial involvement appeared in 100 per cent. The authors believe that rheumatoid (infectious) arthritis, no matter what it may be, is not a disease of the heart; acute rheumatic fever is preeminently a carditis. The clinical application is this. In a case in which the differential diagnosis between rheumatoid (infectious) arthritis and acute rheumatic fever is difficult, if there are no electrocardiographic evidences of myocardial involvement, the authors would be prone to call it the former disease, whereas when there are electrical tracings definitely indicative of myocardial involvement they would be prone to call the disease acute rheumatic fever. The former affects the heart to the slightest degree, if at all; the latter to a maximum extent.

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#### LOCAL ANESTHESIA IN TRAUMATIC SURGERY

On the basis of 2,043 operations performed under local anesthesia, of which only 8 required the addition of inhalation anesthesia, Lieut. Commander M. D. Willcutts, Medical Corps, United States Navy, in an article "Local anesthesia as a factor in reducing the morbidity of traumatic surgery" appearing in the February 15, 1932, number of Surgery, Gynecology, and Obstetrics, draws the following conclusions:

\* \* \* we can not emphasize too strongly that traumatic surgery affords an ideal field for local anesthesia. The advantages are great to both patient and surgeon. The development of local technique increases respect for tissue, the surgeon is requited, and the patient blessed by a gratifying reduction in postoperative morbidity. The current series of over 2,000 consecutive general surgical cases show the extent and safety of the scope of local anesthesia. The employment of intramuscular injection of procaine in the treatment of fractures is particularly emphasized, and it is hoped that the extension of the scope of local anesthesia by the expedient combination of local infiltration with regional blocking, or in combination with spinal analgesia, may create critical comment.

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#### PRESENT TREND IN NURSES' TRAINING

On February 17, 1932, through the courtesy and interest of station WOL, Miss J. Beatrice Bowman, superintendent, Nurse Corps, United States Navy, in behalf of the Graduate Nurses' Association of the District of Columbia, delivered the following radio address:

The professional nurse has climbed a ladder rather rapidly in the past 10 years. Due to the rapid strides made, a broad educational background is necessary for the young woman who enters an accredited school of nursing to-day, as she must keep step with the progress made by the medical profession, whose ally she is. The general public has not kept pace with the progress made and



does not realize that a school of nursing is an educational institution which educates young women to become skilled nurses just as a medical school educates young men to become skilled physicians. The days when young women may leave high school after one or two years' attendance, to enter a school of nursing, are over. The nurse of to-day has had at least 4 years of high-school work and many have had from 1 to 4 years of college work.

The future holds even greater things and we hope to see the time when schools of nursing have the same standing and are conducted in somewhat the same manner as are schools of medicine.

"Nursing," writes Miss M. Adelaide Nutting,<sup>1</sup> former director of the department of nursing education, Teachers College, Columbia University, New York, "is a sick profession \* \* \*. Hospitals were never established as educational institutions. They were established for the care of the sick. The school of nursing must have its own funds, its own faculty, its own board. Its students must receive much of their nursing education in hospitals but the hospitals must be provided with a stable nursing service, graduate nurses supplemented by attendants into which the students can be introduced for their periods of practice. Even so they will continue to give much to the hospitals."

Much readjustment to this end is necessary and this should be brought about by a sane process of evolution rather than that of revolution. Already, we find results from the work of the grading committee which courageously sounded the warning.

An article published in the American Journal of Nursing by Dr. J. C. Geiger<sup>2</sup> states: "The San Francisco Department of Health has looked into the future of nursing care for the public and has decided to discontinue the San Francisco Hospital School of Nursing as an undergraduate institution. Beginning January 1, 1932, no more student nurses will be accepted for training, and a postgraduate school will be established, with a large staff of permanently employed graduate nurses. This decision follows a careful analysis of costs of patient care, as well as of the problems of nursing education and was made with an appreciation of the fact that a school's responsibility in the training of nurses is as great as is its responsibility to supply care to the patients of the hospitals with which it is associated." This San Francisco Hospital has a bed capacity of 1,100 and a nursing school of 111 pupils.

It is felt that nursing should become a university course and that hospitals should accept as eligible for internship nurses as well as doctors. The nursing school of to-day as a financial asset for the hospital must cease to exist and nurses should not be in the position of glorified housemaids in hospitals where they expect to receive a professional education.

In this age when organization means so much, graduate nurses have their local, district, and state associations to help adjust the more local problems; then there is the national organization, the American Nurses' Association, which has the national outlook and tries to be of even broader service. The American Nurses' Association has 108,000 members who are keenly alive to the present day problems in nursing, and all are working hard to adjust the nursing situation to the present day needs of the public. The association's aim is to give to the people of America the highest grade of nursing service, while protecting and forwarding the condition of its members.

Although the primary object of the nursing profession is service to the public, the nurses have their own problems in making others see that in order to give efficient service, they must be in the best condition, both physically and mentally.

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<sup>1</sup> A new portrait of Miss Nutting, *Am. J. Nursing*, 32:181, February, 1932.

<sup>2</sup> Geiger, J. C., An Important Change in Policy, *Am. J. Nursing*, 32:180, February, 1932.

They need rest and recreation as do other mortals and the three years spent in the school of nursing do not fit them to work 24 hours a day but do fit them to render intelligent care to the sick provided they are in the proper physical conditions to do so. A tired, overworked nurse cannot create the bright helpful atmosphere that is so beneficial to the patient.

Again quoting the *American Journal of Nursing*\* "We hear much of the good nursing of an older day. Is there any foundation for such invidious comparison? Dean Rappleye of the College of Physicians and Surgeons, Columbia University, says that medicine has made more progress in the past 40 years than in the preceding 4,000. Consider the medicine of even 20 years ago. Compare it with medicine to-day with its multitude of precise diagnostic procedures and we realize that it then tended to be based on symptoms rather than on accurate diagnosis. The nurse with a bottle of rubbing alcohol represented comfort to the patient who spent many long days in bed, and, because illnesses were long and the tempo of treatment slow, the nurse came to know her patient as a person and to deal with him as such. Those days have gone.

"To-day the whole tempo is speeded up. Also, students are younger. Life has not had time to teach them the sympathy that is based on real understanding. The patient is subjected to many more diagnostic procedures and to relatively fewer treatments. The period of diagnosis is increased and the period of treatment shortened."

We, of course, must recognize that the patient and nurse alike are living a life of progress in a more scientific age and both are called upon for some adjustment in order to receive the maximum benefit.

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#### THE PREVENTION OF THE INTRODUCTION OF DISEASES FROM ABROAD

In a report recently made public, Surgeon General H. S. Cumming, of the Public Health Service, points out that at the beginning of the past fiscal year cholera was present in epidemic form in several islands of the Philippine Archipelago. There was a minor extension to the city of Manila, some 50 cases occurring there. Interisland quarantine was enforced against several insular ports at various times during the year. It is not likely that this epidemic, however, followed any recent importation of the infection, as past history shows that cholera recurs in epidemic form in these islands every four or five years, and may be considered as endemic there.

During the past fiscal year no instance occurred of the importation from abroad of any quarantinable disease into the United States. Several cases of quarantinable diseases reached our quarantine stations and were detained.

Health conditions during the year, as regards the possible presence of yellow fever near certain ports of South America on the Caribbean coast, particularly the western part, and on the east coast from the Amazon River to Rio de Janeiro, were such as to warrant the issuance of instructions to quarantine officers at stations located on the Gulf and Atlantic coast south of the southern boundary of Mary-

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\* Editorial. *Am. J. Nursing*, 32: 187, February, 1932.

land to be particularly on the alert in making the quarantine inspection of vessels which have called at the smaller ports along the east and Caribbean coasts of South America. It is understood that the Brazilian authorities are conducting an effective antimosquito campaign in the principal seaports and that danger of maritime spread is decreased accordingly. Information received from reliable unofficial sources indicates the occurrence of suspected cases of yellow fever in the interior of Colombia, in the region of Santa Marta and Barranquilla, but as yet these reports lack official confirmation.

\* \* \* The problem of the sanitary control of aerial navigation has been receiving international attention for several years, finally culminating in a proposed international convention for the sanitary control of aerial navigation. This proposed convention formed the principal topic for discussion at the two last meetings of the Permanent Committee of the International Office of Public Hygiene in Paris, October, 1930, and May, 1931, as well as at the meeting in April, 1931, of the Second Pan American Conference of Directors of Health held in Washington, D. C., under the auspices of the Pan American Sanitary Bureau.

Of international interest, also, is the problem of the control of psittacosis. This subject will form one of the major topics for discussion at the forthcoming meeting of the Permanent Committee of the International Office of Public Hygiene in Paris in October, 1931. The regulations of the United States for the control of this disease prescribed by an Executive order issued by the President on January 24, 1931, restricting, for the time being, the introduction of parrots into the United States, having been modified during the past year to permit the importation of commercial shipments of these birds under approved sanitary restrictions relating to crates, air space, and other conditions of transportation.

During the past year a change has been made in the application of the measures designed to prevent the spread of typhus fever at ports of embarkation. This step was taken in view of the better organization of sanitary services and improvements in sanitary conditions now obtaining throughout Europe. Where formerly the application of the measures designed to prevent the spread of typhus fever was based on broad geographical areas, now the application is contingent upon the actual endemic or epidemic prevalence of typhus fever in such ports, places, or areas from which persons destined for the United States have originated or embarked.

Special studies of the fumigation of ships as a plague-preventive measure, which were begun last year at the New York quarantine station, were continued during the past fiscal year with marked progress. \* \* \*

**AMERICAN PUBLIC HEALTH ASSOCIATION ANNUAL MEETING**

The American Public Health Association, oldest and strongest organization of its kind on the continent, will hold its sixty-first annual meeting, October 24-27, in Washington, D. C., with the Willard Hotel as headquarters.

The annual meetings of the American Public Health Association attract an attendance of about 2,000—from every State in the Union, from Canada, Mexico, and even from abroad. The scientific programs are planned to interest health officers, nurses, food and nutrition experts, sanitary engineers, school physicians, directors of hospitals, laboratories, and clinics, child and industrial hygienists, and specialists in all branches of public health.

The program committee will begin its work at a meeting to be held in New York early in January. The local committee in charge of local arrangements has already begun to function, under the direction of the general chairman, Dr. William C. Fowler, health officer of Washington.

Additional information may be obtained from the office of the American Public Health Association, 450 Seventh Avenue, New York, N. Y.

## BOOK NOTICES

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Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,  
Bureau of Medicine and Surgery, Navy Department,  
Washington, D. C.

(For review)

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SURGEON OF THE SEAS. THE ADVENTUROUS LIFE OF SURGEON GENERAL JONATHAN M. FOLTZ IN THE DAYS OF THE WOODEN SHIPS. TOLD FROM HIS NOTES OF MOMENT by *Charles S. Foltz*. Bobbs-Merrill Co., Indianapolis, 1931

No medical officer interested in the traditions of his corps could fail to read this book without enjoyment and profit. It covers the personal experiences of a naval surgeon from 1831 to 1873, a period of 42 years, during which time he took an active part in two of the wars of the United States.

The author has divided his tale into four epochs. The first part is entitled "A Long Cruise and a Battle," and teems with incidents of interest, such as a voyage into the Indian Ocean against the pirates of Quallah Batoo, an historical incident long forgotten; sailing-ship cruising in China and Honolulu in 1832; and a voyage around Cape Horn.

The second part is entitled "From Our Country in Its Boyhood to Old Lands in Distress." In this section his intimate acquaintance with life in Washington City places him in position as a diarist to record incidents and opinions which could hardly fail to be of deep historical interest, not the least is the part he took in the Graves-Crilly duel. His visits to England, France, and Algiers on the way to Minorca teem with experiences seldom revealed to us, of the life of a naval surgeon of those days.

Part 3 includes: War on the Plata, our war with Mexico, President Polk, and intimate notes of President Buchanan. Trouble in South America is told by one who was on the spot, and who had an advantage of official position that makes the tale of unflagging interest. His position as fleet surgeon during the Mexican War gave him an intimate acquaintance with the ravages of scurvy on the

blockade, a phase of the war little dealt with, although Foltz told the story in medical journals of the day. As personal physician to Polk and Buchanan, occupying a room in the White House some of the time, his journals are a mine of interest and entertainment.

Part 4, *The Civil War as a Naval Surgeon Saw It*, is splendidly told. As he was Farragut's fleet surgeon, on board the *Hartford*, he participated in the operations at New Orleans, Vicksburg, and along the Mississippi. His first-hand information, jotted day by day in his journal, creates an intensely human story, which must be read to be appreciated.

The final section, part 5, is entitled, "Our Naval Demonstration Abroad—Surgeon General." Now he participated in Farragut's European cruise on the *Franklin* to France, Russia, Sweden, Denmark, Austria, Turkey, and Germany, an epoch of European history pregnant with interest. Finally, he came home to be appointed Surgeon General under President Grant.

The book contains 27 chapters of sustained interest. The story is told with rare discrimination in selecting a readable tale out of what must have been a large treasury of personal diaries and letters. The illustrations are well chosen. The book is a distinct contribution to the history of the Medical Corps of the Navy.

**MEDICAL MEN IN THE AMERICAN REVOLUTION 1775-1783**, by *Louis C. Duncan*, Lieutenant Colonel, United States Army, Retired. Medical Field Service School, Carlisle Barracks, Pa., 1931

Considering that thousands of books have been written on the American Revolution and that these have covered practically every imaginable phase of the subject, it is a little startling and decidedly refreshing to find here a book which treats an angle of the struggle that never before received any notice beyond a mere surface scratch.

The fact that historians of the Revolution have so uniformly ignored the medical situation seems all the more odd when we contemplate the enormous sick and death rates in the American Army of that period (especially high in comparison to the rates among the relatively well fed and clothed and garrisoned and hospitalized British troops), and the serious handicap these rates produced in all of the American campaigns.

This work by Colonel Duncan is of course of the greatest value to Army medical historians, as well as to American medical historians in general. It is regrettable and disappointing to Navy medical men that the book, especially with its particular title, omits any mention of naval medicine of the period. Incidentally, the appendix does contain a list of some 1,400 physicians who served, including about 50 names of naval medical officers. This is perhaps the most complete and accurate list of its kind yet published.

The first chapters include a quite readable and informing presentation of American medicine in the late eighteenth century and a forceful account of the high position the profession held in American public life 150 years ago. Here, again, is the story of the force of epidemic diseases in the fortunes of war. Smallpox and typhus and other scourges raged almost constantly.

The latter half of the book makes quite smooth reading, with the large element of human interest in the well-done biographical sketches of such men as Shippen and Cochran, whereas the earlier chapters are plainly dull, except for reference purposes, since they contain a heavy mixture of official documents and correspondence.

Those interested in biographical items on Benjamin Rush may find some new material here. He evidently was one of the very earliest writers on military medicine, his manual called *Directions for Preserving the Health of Soldiers*, dated 1777, contains several points of high worth. His observation on typhus was brilliant and prophetic: "The contagion of this fever is frequently conveyed from the hospital to the camp by means of blankets and clothes."

A splendid feature of the book will be found in the number and quality of the illustrations. Among the portraits are those of Joseph and John Warren, James Tilton, James Craik, John Morgan, Benjamin Rush, and Stuart's portrait of Shippen. Among the etchings are several of great historical interest, including those of Kings College, the General Hospital of Quebec, and the New York Hospital (1777). That of the New York Hospital is of timely interest, since the old buildings on Sixteenth Street are being abandoned this year for the magnificent new building uptown on the East River.

This book inspires the hope that a naval medical officer will some day find the industry and patience and interest shown by Colonel Duncan and will compile an equally complete account of naval medical matters for the first years of the Navy.

*THE STORY OF MEDICINE*, By Victor Robinson, M. D., Professor of History of Medicine, Temple University School of Medicine, Philadelphia, Pa. Albert and Charles Bonl, New York, 1932. Price \$5

Among a very considerable array of medical historical works read by this reviewer, Robinson's *Story of Medicine* stands by all odds as the most unique. The very fact that it is published by a house that produces strictly for popular consumption puts it almost at once in a class by itself. And the same fact is virtually a guarantee that the story is diverting, absorbing, intriguing, and bears all the marks of a craftsman who has an amazing store of material at his pen point and a surpassing skill in choosing a pattern and applying the fine touches of detail that make for sustained entertainment.

It is rather startling to find a publisher of popular works in such a venture, and one may wonder whether this means that the public has suddenly taken to this subject or if this book has the extraordinary merit of being able to force so wholesome a thing as an introduction to the history of medicine on an unsuspecting public.

Robinson has a sure-fire formula that is bound to carry the reader from page to page with never a yawn or the drop of an eyelid. This formula is twofold. First, he makes living, breathing, sweating, and hoping persons out of countless characters of medical history that might have remained for many of us mere names and morsels of mustiness. Second, whenever he comes to an area that is the least bit lacking in spice he turns on the sex and the scandal and the crime and mystery story mixture. The result is a tabloid-Rabelais effect that stops just short of the limits of New England laws.

The chapter on American medicine is particularly engaging and presents in the most vivid and moving fashion perhaps yet attained such well known events as: The puncture of the Rush myth by Holmes, the birth of American medical journalism, Ephraim McDowell's exploits, the yellow-fever epidemics, the Beaumont experiments, the discovery of ether anesthesia, and the triumphs and travels of Sims.

Here, if ever, is a decidedly palatable history of medicine, and one which will delight and captivate both layman and doctor and will supply many hours of entertainment of an enduring high value.

The few inaccuracies noted are essentially minor and detract nothing from the pleasure of the story or from its general authenticity.

*ITALIAN MEDICINE*, by *Arturo Castiglioni, M. D., Professor of the History of Medicine, Royal University of Padua, Italy.* Paul B. Hoeber (Inc.), New York, 1932. Price, \$1.50

This little volume is one of a series of primers on the history of medicine, edited by E. B. Krumbhaar, professor of pathology, University of Pennsylvania, and published by Paul B. Hoeber (Inc.).

Those previously published include: *The Beginnings: Egypt and Assyria*, by Warren R. Dawson; *Medicine in the British Isles*, by Sir D'Arcy Power; *Physiology*, by John F. Fulton; *Anatomy*, by George W. Corner; and *Internal Medicine*, by Sir Humphrey Rolleston.

In this volume the author traces the history of Italian medicine from its origin in Southern Italy—the philosophic schools of Greece—through the schools of Monte Cassino and Salerno, the universities (especially Padua and Bologna), the Renaissance, and to modern times.

A bibliography is appended for those desiring further reading.



**SURGICAL ERRORS AND SAFEGUARDS**, by *Max Thorek, M. D., Surgeon in Chief, the American Hospital, Chicago; Corresponding Member, Société des Chirurgiens de Paris, France; Associate, Royal Academy of Medicine, Torino, Italy; etc., etc.* With a Foreword by *Arthur Dean Bevan, M. D., Professor and Head of the Department of Surgery, Rush Medical College of the University of Chicago.* J. B. Lippincott Co., Philadelphia, 1932

Here is a book that will be read with great pleasure by the surgeon who has had enough years of experience to appreciate it. Certainly it is not the book to give to the beginner. When a man has progressed to the point where he tries to analyze the difficulties and possibilities of error of each operation he performs, he should read this book.

Doctor Thorek has had over 25 years of experience in the practice and clinical teaching of general surgery. One who follows the surgical literature closely will remember the numerous articles of great practical value by this author. He has now combined all the fruits of his years of experience and of his observations of the successes and failures of himself and others. The result is a book that every advanced surgeon should read.

The type is large and clear, making easy reading. A contrasting type is used for important passages. Consideration of each part of the body begins with a short description of the anatomy of the part and attention is called to the important structures of that region. The author then tells what not to do, how to avoid complications and technical errors, or how to act when face to face with some of the abnormal circumstances which constantly present themselves during the course of a surgical operation.

The only criticism is a most pedantic one, the repeated use of "*locus minoris resistantiæ*" instead of its more lucid English equivalent.

This book is to be welcomed as a definitely useful addition to the surgical bookshelf.

**SURGICAL PATHOLOGY OF THE FEMALE GENERATIVE ORGANS**, by *Arthur E. Hertzler, M. D., Surgeon to the Agnes Hertzler Memorial Hospital, Halstead, Kans.; Professor of Surgery, University of Kansas.* J. B. Lippincott Co., Philadelphia, 1932

This is the fourth volume of a proposed 10-volume series which is to cover the field of surgical pathology. Like the three earlier volumes, which have already been reviewed in *THE BULLETIN*, it is full of the pithy aphorisms which are characteristic of Doctor Hertzler's writings.

It would be difficult to find anyone more capable or better prepared than Doctor Hertzler to produce such an ambitious series of books. His 30 years of teaching and his enormous clinical experience, combined with his persistent pathological research and his

gift for expressing important ideas in a few easily remembered words, make any book produced by him important.

The four volumes that have appeared are of such a high standard of usefulness that those to come are eagerly awaited. This series will make a valuable addition to the libraries of our naval hospitals.

A CLINICAL STUDY OF THE ABDOMINAL CAVITY AND PERITONEUM. by *Edward Meakin Livingston, B. Sc., M. D., Associate Visiting Surgeon, Bellevue Hospital, N. Y.* Paul B. Hoeber (Inc.), New York, 1932

Here is a book that will bring delight to three classes of people: First, the student; second, the practitioner; third, the bibliophile.

The student will find a careful study of the anatomy, embryology, and physiology of the abdomen and its contents, each detail linked to its practical clinical application. An appendix contains more than a thousand questions, based on the text, thus providing a convenient means for systematic study.

For the practitioner, the author successfully attempts to visualize surgical problems with both a microscopic and a telescopic range. It is a volume of broad scope, with an enormous amount of clinical information, the application of which is clearly detailed.

The bibliophile will be pleased with the general make-up of the book, the binding, the paper, the large clear type, and the illustrations.

In the first section of the book, which treats of the abdomen as an empty cavity, there are descriptions of the roof, the floor, and the walls, topography, with a description of the intraperitoneal fluids and pressure variations within the abdomen. The second section, on the gastrointestinal tract, has chapters on the basic embryological considerations, anatomical and physiological divisions of the tract, the abdominal vascular system, the abdominal lymph vessels, and the lymphatic glands.

The third section, on visceral neurology, has chapters on innervation of the walls, clinical significance of segmentation, innervation of the gastrointestinal tract, the sympathetic and parasympathetic divisions of the involuntary nervous system, viscerogenic reflexes, gastrointestinal reflex phenomena, and the clinical interpretation of viscerosensory phenomena. The reviewer believes that the greatest surgical advances of the next few years will be in the surgery of the sympathetic nervous system, so he found this section of the book to be most complete and a valuable reference work.

It is noted that this most creditable volume is the first of a series of monographs, the second of which is to be on preoperative and postoperative treatment, by R. A. Cutting. Those who have been following the excellent articles on this subject by Doctor Cutting, which have been running in the *American Journal of Surgery*, will anticipate a worthy companion to the present volume.

**VARICOSE VEINS**, by *H. O. McPheeters, M. D., F. A. C. S., Director of the Varicose Vein and Ulcer Clinic, Minneapolis General Hospital, Minneapolis, Minn.; etc.* Third edition. F. A. Davis Co., Philadelphia, 1931. Price, \$4

The fact that this book, which was first published in 1929, has already reached its third edition attests its generous reception by the medical profession and also the interest there is in this subject.

The first edition of this work was reviewed in the January, 1930 number, and the second edition in the July, 1930 number of the **BULLETIN**.

This third edition has been enlarged and contains many improvements and additions.

The new material includes reports of experiments with new technic; recent studies on blood pressure; pathological work on biopsy specimens; the chapter on elephantiasis has been expanded to include the elephantoid states due to lymphatic obstruction; and a new chapter has been added on The Causes of Failure in the Injection Treatment of Varicose Veins. A list of references and an extensive bibliography of the subject completes the work.

**RECONSTRUCTION OF THE BILIARY TRACT**, by *Edmund Horgan, M. D., M. S. (in Surgery), F. A. C. S., Washington, D. C.* The Macmillan Co., New York, 1932

Doctor Horgan presents in this volume of 201 pages all of the reconstruction operations upon the biliary tract which have been devised. Each operation is clearly and concisely described, illustrated, and evaluated on the basis of the functional results obtained from its use.

The anatomical variations in the bile ducts, surgical trauma to the bile ducts, identification of the common bile duct in a secondary operation, bile-duct drainage in reconstruction operations, and the preoperative preparation of the patient are discussed.

A summary of the subject is given, and an extensive bibliography is appended.

**THE TECHNIQUE OF THE NON-PADDED PLASTER CAST**, by *Fritz Schnek, M. D., First Assistant at the Accident Insurance Hospital in Vienna.* Wilhelm Maudrich, Publisher, Vienna, 1932

This little volume discusses the advantages, application, and usages of the nonpadded plaster cast.

It is based on the author's comprehensive experience and contains a wealth of practical information concerning this type of plaster cast.

Of particular value are the numerous instructive illustrations which supplement the text.

It is recommended as a book that will be of interest and value to those specializing in surgery.

CLINICAL RÖNTGEN PATHOLOGY OF THORACIC LESIONS, by *William H. Meyer, M. D., Professor of Röntgenology in the New York Postgraduate Medical School of Columbia University.* Lea & Febiger, Philadelphia, 1932. Price, \$8

This is the first of a series of books on clinical Röntgen pathology being prepared by Doctor Meyer. Each volume will take up the study of such special anatomical parts or structures as could be included in a particular examination. This volume discusses the abnormalities and diseases of the respiratory tract, giving such consideration as is necessary to the underlying and closely related structures.

The text is divided into six sections. The section headings are: The röntgenological study of the thorax; Röntgen pathology; diseases affecting the thoracic cage; special diseases of the respiratory system; lesions of the heart and pericardium; and the esophagus and subphrenic organs in relation to intrathoracic pathology.

The book contains 272 pages and 183 excellent illustrations.

The reader will find the work a source of concise information on the subject.

A RADIOLOGICAL STUDY OF THE PARANASAL SINUSES AND MASTOIDS, by *Amédée Granger, K. C. B., K. C. I., M. D., F. A. C. R., Professor of Radiology, Louisiana State University Medical Center; etc.* Lea & Febiger, Philadelphia, 1932. Price, \$5.50

This monograph of 186 pages was prepared in response to a demand for the author's articles on radiological studies of the paranasal sinuses and the mastoids.

The study began in 1922 to meet the need for radiographs furnishing fuller anatomical details in and more accurate boundary landmarks for the sphenoid sinus and the ethmoid cells. A simplified and standardized technic of making these radiographs was developed.

In view of the success with the sphenoid and ethmoids the study was extended to the adult mastoid and later to the infantile mastoid.

The work is divided into two parts. Part I is a study of the paranasal sinuses, supplemented by 62 radiographs. Part II deals with the mastoids and includes 51 radiographs.

The monograph has been so arranged that the illustrations, which are grouped separately at the end of each part, are readily available for study and reference.

DENTAL RÖNTGENOLOGY, by *LeRoy M. Ennis, D. D. S., Assistant Professor of Röntgenology in the Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania; etc.* Lea & Febiger, Philadelphia, 1931. Price, \$6.50

Röntgen diagnosis has long since become an integral part of the practice of modern dentistry. In fact Doctor Ennis rightly states: "The scientific dentist must concede that it is absolutely impossible to practice properly, thoroughly, without the assistance of Röntgen-

ology as an aid to diagnosis. \* \* \* No factor in the practice of dentistry plays a more important part." Therefore, the appearance of an up-to-date work to meet the needs of the student, practitioner, and specialist is most welcome.

In this book Doctor Ennis presents in an extremely practical manner the essential technical and clinical phases of dental Röntgenology.

Recognizing the importance of an accurate understanding of the underlying pathology in the correct interpretation of Röntgenograms, the author has devoted a large section of the book to dental pathology. Beginning with an introduction on the history of dental Röntgenology, the chapter headings are: The Röntgen-ray tube; Röntgen-ray dermatoses; Intraoral and extraoral technique; Methods of localization; Dental Röntgen-ray films; Routine examination of the oral cavity; Normal anatomical landmarks of the teeth and jaws as seen in the Röntgenogram; Dental pathology in relation to Röntgenology; and Localization of root canals and fistulous tracts by use of lipiodol.

This book is commended to all members of the dental profession, and especially to the specialists in dental Röntgenology.

**UNITED STATES ARMY X-RAY MANUAL**, edited by *Lieut. Col. H. C. Pillsbury, M. C., U. S. A.* Second edition. Paul B. Hoeber (Inc.), New York, 1932

This manual was originally prepared in 1918 for the purpose of serving as a guide to Röntgenologists who were doing the X-ray work in Army hospitals and as a textbook for instruction in military Röntgenology. Since its first appearance it has been frequently reprinted.

This second edition, however, has been completely revised in order to keep abreast of the advances made in this field.

The aim has been to supply a condensed description that covers apparatus, technic, and interpretation. For therapy and analysis of the unusual case the reader is referred to the larger works.

A number of new illustrations have been added and the revision has been accomplished without enlarging the size of the manual.

**APPROVED LABORATORY TECHNIC**, by *John A. Kolmer, M. D., Dr. P. H., D. Sc., LL. D., Professor of Pathology and Bacteriology, Graduate School of Medicine, Temple University, etc.; and Fred. Boerner, V. M. D., Associate Professor of Bacteriology, Graduate School of Medicine, University of Pennsylvania.* D. Appleton & Co., New York, 1931

A manual on laboratory technic prepared under the auspices of the American Society of Clinical Pathologists for the purpose of establishing "standards for the performance of various laboratory examinations, to promote the practice of scientific medicine by a wider application of clinical laboratory methods to the diagnosis of

disease and to encourage a closer cooperation between the practitioner and the clinical pathologist."

Committees of the American Society of Clinical Pathologists have approved the technic of the methods given, but the authors specifically state that: " \* \* \* there has been no attempt at present on the part of the society to approve or recommend any of the *methods* for the diagnosis of disease. The authors alone assume full responsibility for the selection of these and in some instances have included two or more for the same examination, when it was impossible to decide upon one and when it was considered advisable to furnish alternate methods for controls."

The entire field of clinical pathology, namely, pathology, bacteriology, serology, biochemistry, and histology, has been covered. In view of the "growing and gratifying increase in the use of laboratory methods by practicing veterinarians in the diagnosis of diseases of the lower animals, an effort has been made to render the manual of equal service to them."

The manual consists of 663 pages supplemented by 311 instructive illustrations.

There was a real need for such a work and this volume meets it splendidly.

**BIOCHEMISTRY IN INTERNAL MEDICINE**, by *Max Trumper, Ph. D., Clinical Chemist and Toxicologist; formerly in charge of the Laboratories of Biochemistry of the Jefferson Medical College and Hospital and of the Psycho-Biochemistry Laboratory, Graduate School of the University of Pennsylvania, and Abraham Cantarow, M. D., Instructor in Medicine, Jefferson Medical College; Assistant Attending Physician, Philadelphia General Hospital; in charge of Laboratory of Biochemistry, Jefferson Hospital, with a foreword by Elmer H. Funk, M. D., Sutherland M. Prevost, Professor of Therapeutics at Jefferson Medical College.* W. B. Saunders Co., Philadelphia, 1932

This volume on biochemistry is not a laboratory manual; in fact, with few exceptions, the technic of laboratory methods has been avoided.

The aim has been, in addition to incorporating all the important recent advances in this field, to correlate established facts with problems encountered daily in internal medicine. The authors state:

Experience in the laboratory and in the clinic has impressed the authors with the difficulty which students and physicians experience in bridging the wide gap between abstract biochemistry or physiology and clinical medicine. Books and articles in abundance have been written for and by specialists, but only a few have attempted to interpret specialized knowledge for the physician. The undergraduate student of medicine and the progressive physician wish to be familiar with the applications of biochemistry to clinical medicine and surgery. They should be as well acquainted with the limitations as with the significance of biochemical findings in any given case. This volume constitutes an attempt to supply this information.

The subjects discussed include carbohydrate, protein, cholesterol, chloride, calcium, and phosphate metabolism; acid-base balance; respiratory exchange and basal metabolism; diabetes mellitus; renal function; nephrosis; hepatic function; chemical investigation of gastric function; pancreatic function; biochemical changes in pregnancy and lactation; cerebrospinal fluid; transudates, exudates, and edema fluid; and miscellaneous urinary findings.

A chapter outlining the chemical diagnostic features of various disorders and giving the normal chemical standards completes the text.

**HANDBOOK OF TROPICAL FEVERS**, by *N. P. Jewell, M. D., D. P. H., F. R. C. S. 1., European Hospital, Nairobi, Kenya*, and *W. H. Kauntze, M. D., D. P. H., Deputy Director of Laboratory Services, Kenya*. William Wood & Co., New York, 1932. Price \$6

A volume discussing the more common tropical and subtropical febrile diseases.

The diseases are arranged in alphabetical order and include amoebiasis, bacillary dysentery, blackwater fever, cholera, dengue, enteric group of fevers in the Tropics, heat exhaustion, heat stroke, and sun traumatism, leishmaniasis, leprosy, leptospirosis, malaria, melioidosis, oroya fever, and verruga peruviana, pappataci fever, plague, psittacosis, rat-bite fever, relapsing fever, smallpox, tropical typhus, human trypanosomiasis, tularaemia, undulant fever, and yellow fever.

The authors have incorporated in the text all the important recent advances, and special attention has been given to treatment.

A handy reference book for those called upon to treat tropical fevers.

**A HAND-BOOK OF OCULAR THERAPEUTICS**, by *Sanford R. Gifford, M. A., M. D., F. A. C. S., Professor of Ophthalmology, Northwestern University Medical School, Chicago, Ill., etc.* Lea & Febiger, Philadelphia, 1932. Price, \$3.25

This work gives in a clear and concise manner a wealth of practical information on the treatment of diseases and injuries of the eye and adnexa. The more modern methods that have proven effective have been included.

The author confines himself strictly to therapeutics; pathogenesis and diagnosis are included only where they definitely relate to treatment.

Minor surgical procedures, which are regarded as a part of office treatment, are given in detail. Surgery in general, however, is discussed only in as far as it concerns the indications for operation.

The book consists of 272 pages with 36 engravings.

**PHYSIOLOGY OF EXERCISE**, by *Ferdinand August Schmidt, M. D., late Director of Health of Bonn, Germany, and Wolfgang Kohlrausch, M. D., Berlin, Germany.* Authorized translation from the German by *Carl B. Spath, M. D., Dean of the Department of Science and Hygiene, Normal College, A. G. U., and Associate in Department of Ophthalmology, Indiana University School of Medicine, Indianapolis.* F. A. Davis Co., Philadelphia, 1931. Price, \$2.50

The authors of this work show by the text that they have given considerable time and study to the subject of the physiology of exercise.

In a very readable manner they present a wealth of information of particular value to students and teachers of physical education.

The scope of the book is well shown by the chapter headings which follow: Growth and physical development; Anatomicophysiological conception of bodily exercise; Effects of bodily exercises on bones and joints; Effects of bodily exercises on local muscle groups; Physiological processes in muscular work and the influence of exercises upon them; Physiological training of the nervous system through physical exercises; Influence of gymnastics upon the development of the lungs and respiration; Influence of physical training upon the heart and its activities; Influence of bodily exercises upon metabolism; Physiological value of the different kinds of exercises; Need for exercise by different age groups; and Constitutional and athletic types.

A table of measurements of various types of athletes completes the text.

**ELECTROTHERAPY AND THE ELEMENTS OF LIGHT THERAPY**, by *Richard Kovács, M. D., Clinical Professor and Director of Physical Therapy, Polyclinic Medical School and Hospital, New York; etc.* Lea & Febiger, Philadelphia, 1932. Price \$6.50

Every physician using physical therapy as part of his routine practice, as well as those specializing in this field, will welcome the appearance of this book.

Doctor Kovács supplies the heretofore lack of clear-cut and correlated experimental and clinical data on the effects of the various physical energies under physiological and pathological conditions.

The plan of the book is well described by the author.

\* \* \* Beginning with elementary electrophysics to lead up to the physics of the different electrical currents covering the apparatus for their production, explaining their action upon the body and describing the technique of application, the indications, contraindications, and the possible dangers involved. A section on applied electrotherapy discusses the rationale and the methods of application in the principal pathological conditions. The correlated or interchangeable use of other, and often simpler, physical measures is emphasized throughout. A brief exposition of the theory and practice of light therapy has been added and will serve as a practical guide for the beginner in electrotherapy and light therapy.



Throughout the text it has been the author's aim to show the possibilities and the limitations of the physical therapy that can be applied by the general practitioner in his own office.

In addition to calling attention to a lack of a universally accepted terminology in physical therapy, the author has appended an electrical glossary issued by the council on physical therapy of the American Medical Association.

There is a real need for such a work and this volume meets it splendidly.

**TEXTBOOK OF GYNECOLOGY FOR NURSES**, by *Philip J. Reel, M. D., F. A. C. S., Assistant Professor of Surgery, College of Medicine, Ohio State University; etc.* F. A. Davis Co., Philadelphia, 1932. Price \$2.50

With the progress of education in nursing and in modern nursing practice, it is obvious that no single text can be adequate for the teaching of nursing practice.

Special books on special branches of nursing are necessary if the nurse is to become something more than a technician, performing a purely mechanical rôle.

For the understanding and management of the gynecological case the nurse will find this an excellent little book.

To assist the pupil nurse and also the graduate nurse preparing for a supervisory position a list of review questions is given at the end of each chapter.

The book contains 269 pages of text and 81 well-chosen illustrations.

**THE SURGICAL CLINICS OF NORTH AMERICA**, FEBRUARY, 1932, VOLUME 12, No. 1. W. B. Saunders Co., Philadelphia, 1932

This is a Chicago number of the well-known surgical clinics and contains a number of interesting papers on the problems of surgical practice.

The first paper is by Dr. Arthur Dean Bevan on abdominal actinomycosis and perforating peptic ulcer of the duodenum. For successful treatment of abdominal actinomycosis, he advocates a radical local opening of the abscesses and fistulous tracts; continued after-management of the wound until solid healing by granulations from the bottom is obtained; X-ray therapy; the use of potassium iodide and copper; and stresses the importance of hygienic, dietetic, and sunshine treatment.

The second paper is a presentation of a case of penetrating gastric ulcer by Drs. A. D. Bevan and D. P. Abbott. In discussing peptic ulcers they are of the opinion that the majority can be controlled and cured by proper medical treatment, especially the Sippy medical management, and that medical treatment is always indicated in the

early history of these cases. However, they point out that there is a considerable percentage of cases where an operation is necessary for a cure. Where an operation is required, their experience has led them to favor, as a general proposition, a gastroenterostomy for duodenal ulcers and a resection for gastric ulcers.

Dr. H. L. Kretschmer has written an interesting paper on benign hypertrophy of the prostate. In addition to describing the type of operation indicated in the five cases presented, the preoperative study and preparation of the patient are discussed.

Dr. C. A. Hedblom and W. Van Hazel contribute an article on surgical treatment of early pulmonary tuberculosis. Four cases are presented illustrating the good results that may be obtained by surgical treatment based on the principles of rest and compression of the tuberculous lung.

THE MEDICAL CLINICS OF NORTH AMERICA, JANUARY, 1932. W. B. Saunders Co., Philadelphia, 1932

The January number of the medical clinics is a Boston number, and many of the contributors are well-known members of the staff of the Harvard Medical School.

Dr. G. R. Minot contributes an article on chronic arthritis with remarks concerning prevention and treatment.

Drs. E. P. Joslin, H. F. Root, P. White, W. R. Jordan, and H. M. Hunt, present a very complete and instructive article on diabetic coma. The paper analyses, with particular reference to the results of treatment without alkalies, a series of 179 instances of coma in 154 individuals.

Drs. H. B. Sprague and P. D. White discuss the indications for and the results of pericardial resections. They report five cases operated on in an attempt to relieve symptoms due to chronic constrictive pericarditis.

Dr. W. P. Murphy presents three cases of anemia and emphasizes the importance of rather complete examinations of the blood routinely.

CONQUERING ARTHRITIS, by *H. M. Margolis, M. D.* The Macmillan Co., 1931. Price, \$2

The author has written a book which is intermediate between the scientific and the lay press. The subject of arthritis is presented in such a manner that it can be readily understood by the patient or general reader.

HOW'S YOUR BLOOD PRESSURE, by *Clarence L. Andrews, M. D., Attending Physician and Medical Chief at the Atlantic City Hospital.* The Macmillan Co., New York, 1931

This book is written for the patient and contains nothing new for the physician.

# THE DIVISION OF PREVENTIVE MEDICINE

O. J. MINK, Captain, Medical Corps, United States Navy, in charge

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## A REINVESTIGATION OF THE VALUE OF ACTIVE PNEUMOCOCCUS IMMUNITY: PRELIMINARY REPORT

By DAVID FEROUSSON, Lieutenant Commander, Medical Corps, United States Navy, with the Technical Assistance of JOHN H. DILBURN, Pharmacist's Mate, First Class, United States Navy

### INTRODUCTION

The pneumonias continue to be a leading cause of death and are responsible for a tremendous morbidity. The treatment of these infections remains essentially inadequate and unsatisfactory, despite the introduction of the excellent curative serum by Felton. Therefore, the possibilities of successful *Pneumococcus* immunization offer a most promising field.

During a study of experimentally produced pneumonia in rabbits it became necessary to induce partial immunization. For this purpose a specially prepared vaccine was used. The resulting immunity was so great that a reinvestigation of active *Pneumococcus* immunization was undertaken.

Successful immunization against the pneumonias caused by Types I, II, and III *Pneumococcus* would reduce the incidence of lobar pneumonia about 70 per cent and bronchopneumonia about 20 per cent.

### HISTORICAL

Examination of the reports of attempted immunization of humans against the *Pneumococcus* infections shows that vaccines of the highest antigenic activity have never been used.

Barach (1928) gives an excellent review of the more important contributions to the voluminous literature relating to attempts to induce active immunity against the *Pneumococcus* infections.

Recent medical literature contains 5 important studies of active *Pneumococcus* immunizations in humans, of which 3 were successful and 2 were complete failures. An examination of the methods used in the preparation and administration of the vaccines shown in these five reports reveals important discrepancies.

The first successful experiments were those of F. S. Lister (1913-1917) who carried on the work initiated in South Africa by A. E.

Wright (1912 and 1914). Among the native negro workers in the diamond mines, who are exceedingly susceptible to pneumonia, Wright reported a reduction in the death rate from pneumonia to 6 per thousand in 17,000 vaccinated miners, as against 17 per thousand in 6,700 uninoculated miners who served as controls. Lister, independently of Dochez and Gillespie (1913), isolated 11 different strains of the *Pneumococcus* in addition to a group comprising the unclassified strains, the latter corresponding to the Group IV of the Rockefeller workers. He prepared a heat-killed vaccine from the most prevalent types of *Pneumococcus* and sought to avoid autolysis of the microorganisms by adding glucose solution to the culture after 16 to 18 hours of incubation, and by killing the culture at the twentieth hour. Lister did not emphasize the necessity of using highly virulent strains, as recommended by Neufeld (1905), Cole and Moore (1917), Cecil and Austin (1918), and Barach (1928). Lister's vaccine, given intravenously to rabbits at three and four day intervals, in doses of from 50,000,000 to 2,000,000,000 microorganisms, protected against eight lethal doses of homologous *Pneumococcus* administered subcutaneously. By giving the same vaccine subcutaneously to humans in three doses, at weekly intervals and in amounts of 6,000,000,000 of each group, Lister caused an entire disappearance of the types of *Pneumococcus* vaccinated against, with a tremendous lowering of the incidence of pneumonia among the miners. In the Crown mine, among 11,000 vaccinated natives, only 82 developed pneumonia; none of the cases of pneumonia were due to the types of pneumococci contained in the vaccine.

The second successful human immunization experiment was that of Cecil and Austin (1918). Using cultures of the highest virulence, which were killed by heating at 53° F. for 30 minutes, 12,500 troops were immunized against Type I, Type II, and Type III *Pneumococcus* by four subcutaneous injections given at intervals of one week. The first injection contained 1,000,000,000 of each type; the second injection 2,000,000,000 of each type; the third injection 2,000,000,000 of Type I, 2,000,000,000 of Type II, and 1,500,000,000 of Type III; the fourth injection containing the same dosage as the third.

During a 10-week period of observation only 1 man in the vaccinated group contracted pneumonia due to a fixed-type *Pneumococcus*, as against 35 cases occurring among 15,000 unvaccinated veteran troops and 24 cases among 4,500 unvaccinated recruits.

Cecil and Austin's results were so striking that they are shown in the following table:

*Cecil and Austin's results—United States Army human vaccination experiment, 1918*

	Vaccinated	Unvaccinated	
		Veterans	Recruits
Number of men.....	12,500	15,000	4,500
Number of cases of fixed-type pneumonia.....	1	35	24
Number of cases of <i>Streptococcus</i> pneumonia.....	7	68	38
Number of cases of unclassified pneumonia.....	9	34	17
Total cases of pneumonia.....	17	137	79

No explanation is offered by the authors for the amazingly low incidence of *Streptococcus* pneumonia among the vaccinated personnel.

Following this successful experiment Cecil and Vaughn (1919) vaccinated a large number of troops, using an entirely different vaccine, prepared by Whitmore, Fennel, and Petersen (1918) from type-proven laboratory strains of unknown virulence. The organisms after 18 hours incubation in broth were collected by centrifuging, dried, comminuted by grinding, and suspended in lanolin and cotton-seed oil. A single injection was given. This experiment must be classed as a failure, there being no appreciable difference in the incidence of pneumonia in the vaccinated and the unvaccinated. Fennel (1918) showed that this vaccine was capable of protecting mice against 1,000 lethal doses of Type I *Pneumococcus*.

Von Sholly and Park (1921) inoculated 1,536 volunteers with a vaccine containing the following: *Pneumococcus* Types I, II, and III, *B. influenza*, *Streptococcus hemolyticus* and *Streptococcus viridans*. The vaccine was a saline suspension sterilized by heat; the *Pneumococcus* was type proven but of unknown virulence. Three subcutaneous injections were given to 1,293 volunteers at weekly intervals. The injections contained respectively 2,500,000,000, 5,000,000,000, and 5,000,000,000 *Pneumococcus*, in the proportion of two of Type I and II to one of Type III. During a 6-month period of observation a single case pneumonia (type unspecified) developed among the inoculated, as contrasted with 11 cases among a control group of 3,025; an incidence of 0.065 per cent against 0.36 per cent. The individual developing pneumonia was one of the group receiving only a single injection of the vaccine.

McCoy, Wadsworth, Hasseltine, and Kirkbride (1922) conducted an extensive vaccination experiment which they regard as unsuccessful. They used a vaccine similar in preparation to that used by Cecil and Vaughn. A single injection containing 10,000,000,000 each of Types I, II, and III was administered. Among 17,752 inoculated individuals, 253 cases of pneumonia developed, as against

340 cases among 18,595 controls. They ascribe this apparent benefit to the fact that no one with fever (which possibly represented in some cases an incipient pneumonia) was inoculated.

Von Sholly (1923) reported a second human immunological experiment which was inconclusive.

During a recent visit to the United States, F. S. Lister (personal communication to L. A. Julianelle, 1930) reaffirmed his confidence in the value of active *Pneumococcus* immunization. However, the present medical director of the Crown mines (personal communication to G. W. McCoy (1930) states that although *Pneumococcus* vaccine is regularly given at present, improved sanitary and housing conditions for the miners may be the greater factor responsible for the improved pneumonia morbidity.

H. C. Curl (1930), from his experience with the pneumonia prevalent among the laborers during the building of the Panama Canal, subscribes also to this latter belief, because of the great reduction in the incidence of pneumonia which resulted from correcting overcrowding and insanitary conditions in the barracks which housed the laborers.

#### COMMENT

In the above reports no attempt was made to determine the condition of the bacterial cells in the vaccine during the period of attempted immunization. Although Lister sought to avoid autolysis of the organisms by the addition of glucose to the culture media after 16 to 18 hours' growth, and Cecil and Austin attempted to gain the same results by killing the organisms after 12 to 14 hours' growth, both reports fail to show that the vaccine was examined for autolysis during the period it was in use.

An ordinarily prepared suspension of killed *Pneumococcus* culture undergoes a rather uniform change. The organisms first become Gram-negative, then the cell outline loses its clear definition, and finally the *Pneumococcus* disintegrates into Gram-negative, amorphous débris. This Gram-negative débris has no immunizing power whatever. The killed intact cells, though Gram-negative, have very satisfactory immunizing powers.

Goebel and Avery (1929) studied autolysis of the *Pneumococcus* and found that it is accompanied by proteolysis and lipolysis. In autolysates the type specific antigen was found to undergo a change, whereby it lost in greater part the capacity to stimulate type-specific antibodies.

Neufeld, from his *Pneumococcus* immunological experience, emphasized the employment of highly virulent cultures, believing that the action of immune serum is to neutralize exactly those receptors of the bacterium upon which virulence depends. Cole and Moore

subscribe to this belief and carry the hypothesis a step further by advocating the intravenous injection of vaccines; for the reason that the bacteria, with less opportunity for change, may be brought into contact and react with the cells causing the immunity response.

Another factor of tremendous importance in vaccine therapy and one which has never received sufficient consideration is that of the culture media. Recent investigations disprove the general belief that the antigenic specificities produced by bacteria on artificial culture media are identical with those produced by the same microorganism in a susceptible host (Veblen 1929). This can not be true in the case of the *Pneumococcus* because repeated subculturing invariably results in a progressive loss of virulence. Loss of virulence is necessarily attended by biochemical changes in the microorganism. The effect of these chemical changes should result in an antigen which is incapable of producing the exact receptors for the virulent *Pneumococcus*. The ideal media would be a living animal of a species which has no natural *Pneumococcus* immunity (Rakieta 1930). The ideal artificial culture media for the *Pneumococcus* would be basically a blood derivative.

#### METHOD OF VACCINE PREPARATION

A type-proven strain of the highest virulence is used. A decimal dilution of a highly virulent 6-hour blood-broth culture containing about five microorganisms is injected into a white mouse intraperitoneally. The mouse becomes moribund in from 24 to 36 hours; it is killed and the heart blood is cultured on blood broth. This culture, after 6 to 18 hours of growth, is centrifuged at low speed to throw down the blood cells; the supernatant fluid is transferred to a tube containing 1 cubic centimeter of 2 per cent sodium citrate in normal saline solution and centrifuged at highest speed. The resulting sediment is suspended in a solution of formalin 0.2 per cent and sodium citrate 2 per cent in physiological saline and centrifuged again at highest speed. This sediment is resuspended in 0.2 per cent formalin in saline and placed in an ice box for 12 hours.

Type I cultures are given 18 hours of incubation; Type II, 12 hours; Type III, 6 hours. The results recorded in the various tables dictated this practice.

After ice-boxing, the organisms are centrifuged again, washed twice in saline, and then resuspended in 0.5 per cent phenol in saline. Anaerobic and aerobic cultures are made and 0.5 cubic centimeter of the vaccine is injected into the peritoneal cavity of a mouse as tests for noninfectiousness.

The rationale of these procedures is to obtain for the vaccine only the most virulent strains of *Pneumococcus* and to permit the organisms to undergo a minimum of environmental change. Formalin,

instead of heat is used to kill the organisms, as the resulting vaccine possesses slightly superior antigenic power.

The sodium-citrate solution in saline seems to aid in the removal of the lytic substances present in the culture.

The repeated washings in saline remove the formaldehyde and the lytic principles.

The blood broth used was a 1 per cent solution of defibrinated rabbit blood in beef infusion broth containing 1 per cent peptone and 0.5 per cent salt, with the pH adjusted to 7.8.

The vaccine was always examined for morphological integrity of the pneumococci prior to each injection.

Dilutions of cultures of *Pneumococcus* were made in warmed meat-infusion broth instead of saline, as the latter was found to reduce markedly the virulence of the pneumococci.

Decimal dilutions of cultures were made, though for clarity the approximate number of organisms in the dilution is given. Bacterial suspensions were counted in a counting chamber with a depth of 0.02 millimeter and checked. Discrepancies in counts were rechecked by counting a suitable dilution.

Subcutaneous injections were made under the loose skin of the back between the shoulders.

Inoculations were made intraperitoneally unless otherwise specified.

#### TYPE I IMMUNIZATION EXPERIMENTS

Table 1 shows that a total vaccination of 3,500,000 microorganisms of a heat-killed, subcultured strain of low virulence does not confer any immunity against 400 lethal doses of homologous *Pneumococcus*. Table 2 shows that a total vaccination of 3,000,000 organisms of a formalin-killed, animal passage culture of high virulence confers complete immunity against 60,000 virulent Type I organisms, which is 10,000 lethal doses.

TABLE 1.—Type I, vaccination with an ordinarily prepared vaccine

	Date of vaccination, and number of or- ganisms in millions			Inoculation July 8	Result	Post-mortem blood culture	Conclusion
	June 27	June 30	July 3				
1	1	2	1/2	4,000 Type I.....	Died in 22 hours.....	Positive (Type I)...	No immunity. Do.
2	1	2	1/2	80,000 Type I.....	Died in 20 hours.....	do.....	
1	Control.			4,000 Type I.....	Died in 22 hours.....	do.....	
2	Control.			10 Type I.....	Died in 28 hours.....	Positive.....	

*Vaccine*.—A Type I, heat-killed 20-hour subculture of low virulence grown on blood agar, suspended in saline with tricesol.

*Summary*.—No immunity against 400 lethal doses results from this vaccine in the total dosage of 3,500,000 pneumococci.



TABLE 2.—*Type I, multiple vaccination—Type I, vaccination*

	Date of vaccination, and number of organisms in millions			Inoculation June 30	Result July 1	Post-mortem blood culture	Conclusion
	June 20	June 23	June 26				
1	1	1	1	6,000,000 Type I.....	Died in 24 hours.....	Positive.....	No protection.
2	1	1	1	600,000 Type I.....	Died in 44 hours.....	do.....	Slight protection.
3	1	1	1	60,000 Type I.....	Survived.....	do.....	Full protection.
1	Controls.	-----	-----	60,000 Type I.....	Died in 24 hours.....	Positive.....	
				6 Type I.....	Died in 26 hours.....	do.....	

*Vaccine.*—A Type I, 20-hour culture of highest virulence from the heart blood of a white mouse grown on blood agar, killed in 0.2 per cent formalin in saline.

*Summary.*—Protection against 10,000 lethal doses results from this vaccine in a total dosage of 3,000,000 pneumococci.

Table 3 shows that this latter type of vaccine protects mice against 400,000 virulent Type I pneumococci (40,000 lethal doses). The interval between the last dose of vaccine and the inoculation was six days in this experiment and four days in the one reported in Table 2.

TABLE 3.—*Type I multiple vaccination*

	Date of vaccination, and number of organisms in millions			Inoculation July 8	Result July 9	Post-mortem blood culture July 10
	June 26	June 29	July 2			
1	1½	2	2½	4,000 Type I.....	(1).....	(2).
2	1½	2	2½	40,000 Type I.....	(1).....	(2).
3	1½	2	2½	80,000 Type I.....	(1).....	(2).
4	1½	2	2½	200,000 Type I.....	(1).....	(2).
5	1½	2	2½	400,000 Type I.....	(1).....	(2).
	Controls.....	-----	-----	4,000 Type I.....	Died in 22 hours.....	Blood culture (Type I) positive.
				10.....	Died in 28 hours.....	Blood culture positive.

<sup>1</sup> General condition fair though all are subnormal.

<sup>2</sup> All appear perfectly normal.

*Vaccine.*—A formalin-killed, 20-hour culture of Type I *Pneumococcus* of highest virulence from the heart blood of a white mouse.

*Conclusion.*—Protection against 40,000 lethal doses of Type I.

TABLE 4.—*Type I vaccination*

Vaccine	Date of vaccination, and number of organisms in millions			Amount of inoculation	Result	Post-mortem blood culture
	Aug. 11	Aug. 14	Aug. 17	Aug. 23		
51-I.....	2	2	3	400,000	Died in 20 hours.....	Positive.
51-I.....	2	2	3	80,000	Survived.....	
51-I.....	2	2	3	4,000	Died in 28 hours.....	Positive (Type I).
51-0.....	2	2	3	400,000	Died in 29 hours.....	Positive.
51-0.....	2	2	3	4,000	Died in 28 hours.....	Do.
51-0.....	2	2	3	400	Died in 47 hours.....	Do.
Control 1.....	-----	-----	-----	20	Died in 30 hours.....	Positive (Type I).
Control 2.....	-----	-----	-----	20	Died in 27 hours.....	Do.

*Vaccines.*—51-I made from a 12-hour blood agar, Type I culture of high virulence from the heart blood of a mouse, formalin-killed; 51-0 made from a 12-hour blood agar, highly virulent subculture, heat-killed.

*Conclusion.*—No immunity from either vaccine.

The experiment recorded in Table 4 was designed to confirm the results shown in Tables 1 and 2. No immunity was produced by either of the vaccines used. The only difference in the method of preparation of the vaccines used in this unsuccessful experiment was that the culture was grown 12 hours instead of 20 hours. This experiment shows the necessity for testing each batch of vaccine for antigenic powers. A comparison of the results obtained from heat-killed, subcultured, stock-strain vaccines shows a variation in antigenic powers. This is ascribed to the difference in virulence of the organism from which the vaccine is made. Table 1 shows a vaccine with no antigenic powers (made from a stock culture of low virulence), while vaccines 1-86-0 and 1-12-0 (made from a recent animal passage subculture of high virulence) in Table 5 give protection against more than 500 lethal doses.

TABLE 5.—Type I vaccination

	Date of vaccination, and number of organisms 'n millions			Vaccine used	Inoculated, date and number of Type I organisms, Sept. 16	Result	Blood culture and type
	Sept. 4	Sept. 7	Sept. 10				
1	2	2	3	I-86-0	100	Survived.....	Positive (Type I).
2	2	2	3	I-86-0	1,000	do.....	
3	2	2	3	I-12-83	100	do.....	
4	2	2	3	I-12-83	1,000	do.....	
5	2	2	3	I-12-83	400,000	Died in 22 hours.....	
6	2	2	3	I-12-Br	100	Survived.....	
7	2	3	3	I-12-Br	1,000	do.....	
8	2	2	3	I-12-0	100	do.....	
9	2	2	3	I-12-0	1,000	do.....	
10	2	2	3	I-12-0	400,000	Died in 15 hours.....	
11	Control.	-----	-----	-----	2	Died in 39 hours.....	Do.
12	Control.	-----	-----	-----	20	Died in 28 hours.....	Do.

Vaccines.—I-86-0, a heat-killed, subcultured, virulent strain, grown on blood broth for 20 hours; I-12-83, a 20-hour animal passage culture grown on blood agar (killed and washed in 0.2 per cent formalin solution); I-12-Br, same source as I-12-83 but grown on blood broth for 20 hours (killed and washed in 0.2 per cent formalin solution); I-12-0, same as I-12-Br but heat-killed and washed and suspended in saline.

Conclusion.—Protection against 500 lethal doses is conferred by the above vaccines against homologous *Pneumococcus*. No protection against 200,000 lethal doses.

Table 5 records an experiment to determine whether formalin-killed vaccines were superior antigens to heat-killed vaccines made from cultures of approximately equal virulence. It was also designed to determine whether *Pneumococcus* cultures grown on meat infusion broth to which defibrinated rabbit blood was added were as active antigenically as organisms grown on blood agar.

This experiment showed that all of these vaccines conferred immunity against 500 lethal doses of Type I *Pneumococcus*, but that none protected against 200,000 lethal doses. This experiment is repeated in Tables 6 and 7 in which graduated inoculations between 60,000 and 120,000 lethal doses were used.

The vaccines used in the experiments recorded in Tables 6 and 7 were (1) a formalin-killed vaccine obtained from a virulent subculture (818a), (2) a heat-killed vaccine from the same source (818b), (3) a formalin-killed (819a), and (4) a heat-killed (819b) vaccine made from a virulent culture obtained from the heart blood of a mouse.

TABLE 6.—Type I, vaccination

Mouse	Vaccine used	Date of vaccine injections, and number of organisms in millions			Inoculated, date and number of Type I organisms, Sept. 8	Result	Post-mortem blood culture
		Aug. 22	Aug. 27	Sept. 1			
1	818a	4	4	4	400	Survived.....	
2	818a	4	4	4	40,000	do.....	
3	818a	4	4	4	400,000	do.....	
4	818b	4	4	4	400	do.....	
5	818b	4	4	4	40,000	do.....	
6	818b	4	4	4	400,000	do.....	
7	819a	4	4	4	400	do.....	
8	819a	4	4	4	40,000	do.....	
9	819a	4	4	4	400,000	do.....	
10	819b	4	4	4	400	do.....	
11	819b	4	4	4	40,000	do.....	
12	819b	4	4	4	400,000	do.....	
13	Control.	-----	-----	-----	4	Dead in 34 hours.....	Positive Type I. Do.
14	Control.	-----	-----	-----	40	Dead in 25 hours.....	

**Vaccine.**—818a, formalin-killed, virulent, subcultured strain grown 20 hours on blood broth; 818b, heat-killed, virulent, subcultured strain grown 20 hours on blood broth; 819a, formalin-killed, virulent, animal passage strain grown 20 hours on blood broth; 819b, heat-killed, virulent, animal passage strain grown 20 hours on blood broth.

**Summary.**—(1) Regular protection against 100,000 lethal doses of homologous *Pneumococcus* is conferred by each of these vaccines in a total dosage of 12,000,000 pneumococci; (2) the formalin-killed vaccines are not shown to be more efficient than the heat-killed vaccines; (3) the vaccines made from animal-passage cultures are not shown to be more efficient than highly virulent subcultures.

Table 6 shows that all of the above vaccines, in a total dosage of 12,000,000 microorganisms, protected mice against more than 100,000 lethal doses of homologous *Pneumococcus*.

Table 7 shows that the same vaccines in a total dosage of 7,500,000 microorganisms gave protection against 60,000 to 100,000 lethal doses. While no outstanding superior antigenic powers are shown by any of these vaccines over the others, the formalin-killed vaccines show a slight, but definite, superiority over the heat-killed vaccines.

These two protocols confirm the observations of Lister and of Cecil and Austin that larger quantities of vaccine confer greater degrees of immunity.

TABLE 7.—Type I, vaccination

	Vaccine used	Date of vaccine injections, and number of organisms in millions			Inoculated, date and number of organisms, Sept. 28	Result	Blood culture	Conclusions
		Sept. 11	Sept. 17	Sept. 23				
Subcultured: Formalin-killed—								
1.....	818a	1.5	3.0	3.0	180,000	Survived...	-----	Complete protection against 60,000 lethal doses.
2.....	818a	1.5	3.0	3.0	300,000	Dead in 93 hours.	+Type I..	Partial protection against 100,000 lethal doses.
3.....	818a	1.5	3.0	3.0	300,000	Survived...	-----	Complete protection against 100,000 lethal doses.
Heat-killed—								
4.....	818b	1.5	3.0	3.0	180,000	do.....	-----	Complete protection against 60,000 lethal doses.
5.....	818b	1.5	3.0	3.0	360,000	Dead in 26 hours.	+Type I..	No protection against 120,000 lethal doses.
6.....	818b	1.5	4.0	3.0	300,000	Survived...	-----	Complete protection against 100,000 lethal doses.
Animal passage: Formalin-killed—								
7.....	819a	3.0	1.5	3.0	360,000	Dead in 56 hours.	+Type I..	Partial protection against 120,000 lethal doses.
8 <sup>1</sup> .....	819a	3.0	1.5	3.0	300,000	Dead in 50 hours.	+Type I..	Partial protection against 100,000 lethal doses.
9.....	819a	3.0	1.5	3.0	300,000	Survived...	-----	Complete protection against 100,000 lethal doses.
Heat-killed—								
10.....	819b	1.5	3.0	3.0	180,000	Dead in 62 hours.	+Type I..	Partial protection against 60,000 lethal doses.
11.....	819b	1.5	3.0	3.0	300,000	Dead in 25 hours.	+Type I..	No protection against 100,000 lethal doses.
12.....	819b	1.5	3.0	3.0	180,000	Survived...	-----	Complete protection against 60,000 lethal doses.
Control 1.....					0.3	do.....	-----	No organisms in this dilution.
Control 2.....					3	Dead in 28 hours.	+Type I..	
Control 3.....					30	Dead in 34 hours.	+Type I..	

<sup>1</sup> This mouse gave birth to a litter of 5 on Sept. 24.

**Vaccines.**—Same as described in Table 6; the dosage of vaccine is 7,500,000 in Table 7, and 12,000,000 in Table 6.

**Summary.**—(1) Formalin-killed vaccines are superior to heat-killed vaccines; (2) Vaccines prepared from highly-virulent animal passage cultures have no superiority over vaccines prepared from highly-virulent subcultures.

#### COMMENT ON TYPE I EXPERIMENTS

The vaccines used in the experiments recorded in Tables 6 and 7 compare with those developed by other workers as follows:

Barach used a carefully prepared heat-killed vaccine obtained from a highly virulent culture incubated for 6 to 11 hours. Following the daily intraperitoneal injection of 200,000,000 organisms of this vaccine for five successive days (a total amount of 1,000,000,000 killed *Pneumococcus* in contrast to a total of 13,000,000 organisms given subcutaneously in the experiment recorded in Table 7), mice were protected against 100,000 lethal doses of homologous *Pneumococcus*.

Lister, using rabbits, protected them against 8 lethal doses of homologous *Pneumococcus* by injecting intravenously, at 3 and 4 day intervals, 3 doses of from 50,000,000 to 2,000,000,000 organisms. This dosage is to be compared with two and three subcutaneous injections of 100,000,000 organisms each, which completely protected rabbits from intrabronchial infection as shown in Table 12.

### TYPE I IMMUNIZATION

#### *The response to intrabronchial infection*

The experiment recorded in Table 12 was designed to determine if the immunity resulting from the subcutaneous injection of an active *Pneumococcus* vaccine would protect against intrabronchial inoculation of virulent *Pneumococcus*.

Rabbits were immunized by two and three subcutaneous injections. The dose of the vaccine was 100,000,000 organisms at each injection.

Four days, and in some cases seven days after the last vaccine injection the rabbits were anesthetized with ether, tracheotomy performed, a ureteral catheter passed into a primary bronchus and virulent pneumococci slowly injected.

All the immunized rabbits survived the inoculation, although two animals showed evidence by X ray of pulmonary consolidation.

The experiment further shows the variation in the degree of immunity occurring in rabbits following similar *Pneumococcus* vaccination.

TABLE 12

Rabbit No.	Date of vaccination, and number of organisms in millions			Vaccine used	Date of inoculation by tracheotomy and catheter into primary bronchus	Result
	June 17	June 23	June 26			
94	100	100	100	Ra-1	June 30, 1,000,000 (Type I).	Consolidation left base by X ray on July 3. Survived.
81		100	100	Ra-1	July 3, 2,500,000 (Type I).	General pneumonia by X ray on July 4. Cleared on July 7. Killed on July 9.
75		100	100	Ra-1	do	Lungs clear on X ray July 4 and 7. Survived.
77	Control (no vaccine)				do	Died in 67 hours. Post-mortem blood culture positive for Type I <i>Pneumococcus</i> .

*Vaccine.*—Ra-1, a Type I, formalin-killed, 20-hour culture from the heart's blood of a rabbit inoculated intraperitoneally. Culture grown on defibrinated rabbit-blood agar.

#### THE PROTECTION AFFORDED BY IMMUNIZED BLOOD SERUM

Table 14 shows an experiment in which mice 1, 2, 3, and 4 were injected intraperitoneally with from 1 to 1,000 lethal doses of Type I *Pneumococcus* which were mixed with 0.2 centimeter of the inac-

tivated blood serum of an immunized rabbit. These mice were fully protected and survived. Mice 5 and 6 were injected with 1 and 10 lethal doses of Type I *Pneumococcus* mixed with 0.2 centimeter of the inactivated blood serum of an unimmunized rabbit. These mice died as promptly as the controls (mice 7 and 8).

This experiment is vitiated by the fact that the immunized rabbit had also received an intrabronchial injection of living virulent Type I *Pneumococcus*, which probably augmented greatly the initial immunity. At present a confirmation of this experiment is delayed awaiting sufficient experimental animals.

TABLE 14.—To determine protection afforded by the blood serum of an immunized rabbit

	Given simultaneously		Result	Conclusion
		Inoculation number of Type I organisms		
1-----	0.2 Ra-1-----	5	Survived-----	Complete protection.
2-----	0.2 Ra-1-----	50	do-----	Do.
3-----	0.2 Ra-1-----	500	do-----	Do.
4-----	0.2 Ra-1-----	5,000	do-----	Do.
5 (control)-----	0.2 NRS-----	5	Died in 31 hours-----	No protection.
6 (control)-----	0.2 NRS-----	50	do-----	Do.
7 (control)-----	0-----	5	Died in 26 hours-----	Control.
8 (control)-----	0-----	50	Died in 34 hours-----	Do.

NOTE I.—0.2 NRS is 0.2 cubic centimeters—normal rabbit's serum; 0.2 Ra-1 is 0.2 cubic centimeters of inactivated blood serum of rabbit 81.

NOTE II.—Rabbit 81 was vaccinated with 100,000,000 special vaccine on June 26 and June 29. On July 3 he received 2,500,000 Type I pneumococci intrabronchially. On July 4 he showed an X-ray pneumonia, which disappeared on July 7. On July 9 he was killed—his blood collected and lungs sectioned.

Conclusion.—0.2 cubic centimeter of immune rabbit serum protected against 1,000 lethal doses of Type I.

#### TYPE II VACCINATION EXPERIMENTS

Type II immunization experiments have not been completed, due to insufficient animals. The following reports giving the work to date are submitted.

In Table 16 an experiment is recorded which shows that no immunity results from either a formalin-killed culture of high virulence or from a heat-killed culture of low virulence. This experiment shows the necessity for testing every lot of vaccine for its antigenic power.

Table 18 shows the result of an experiment in which a vaccine was used that was of similar origin as that in Experiment XVI but grown on citrated human blood agar instead of defibrinated blood agar. Regular immunity against 2,000 lethal doses resulted.



In Table 19 a regular protection is obtained against more than 2,500 lethal doses of Type II *Pneumococcus*. Liquid and solid culture media were used, and both heat and formalin were employed to sterilize the culture.

The Gram-negative contaminant in the heart blood of mouse No. 3 is assumed to represent an intercurrent infection and to have contributed to the death of this animal.

TABLE 16.—Type II vaccination

Marking	Mouse	Vaccine	Date vaccinated and organisms (in millions)			Date inoculated, number organisms (Type II)	Result	Blood culture post-mortem
			Aug. 11	Aug. 14	Aug. 17			
R1.....	1	55-II.....	2	2	3	2,000	Survived.....	
R2.....	2	do.....	2	2	3	400	Died in 39 hours..	Positive II.
R3.....	3	do.....	2	2	3	200	Died in 48 hours..	Positive.
R1-B1....	4	35 ord.....	2	2	3	2,000	Died in 52 hours..	Positive.
R2-B1....	5	do.....	2	2	3	400	Survived.....	
R1-B2....	6	do.....	2	2	3	200	Died in 30 hours..	Positive II.
Blue X....	7	Control blue..				10	do.....	Positive.
Red X....	8	Control red....				200	Died in 38 hours..	Positive II.

*Vaccine.*—55-II is a Type II, 12-hour virulent blood agar culture from the heart blood of a mouse, washed and killed in formalin 0.2 per cent in saline and resuspended in same solution; 35 Ord. is a Type II, 24-hour blood agar subcultured stock strain of low virulence, washed in saline, killed at 55° C for 30 minutes, tris-cresol 0.3 per cent added.

*Conclusion.*—No regular immunity produced by either vaccine.

TABLE 18.—Type II vaccination

Mouse	Date vaccinated and organisms (in millions)			Inoculated with Type II	Result	Blood culture
	Aug. 18	Aug. 21	Aug. 24			
Blue I.....	2	2	1 3	100	Died in 33 hours.....	+Type II.
Blue II.....	2	2	3	1,000	Survived.....	
Blue III.....	2	2	3	10,000	do.....	
Control I.....				5	Died in 30 hours.....	+Do.
Control II.....				10	Died in 34 hours.....	+Do.
Control III.....				100	Died in 30 hours.....	+Do.

<sup>1</sup> This mouse had an intercurrent illness characterized by weakness and wasting which developed Aug. 24.

*Vaccine.*—II-55 Cit. (a virulent, Type II, 12-hour animal-passage, culture, grown on citrated human blood-agar, formalin-killed).

*Conclusion.*—(1) Definite regular immunity against 2,000 plus lethal doses of Type II; (2) the death of Mouse Blue I was the result of *Pneumococcus* infection. Apparently his intercurrent illness interfered with antibody formation.

TABLE 19.—*Type II vaccination*

Mouse	Vaccine	Date vaccinated and number of organisms given (in millions)			Number inoculated (Type II)	Result	Blood culture and type
		Sept. 5	Sept. 8	Sept. 11			
1 <sup>1</sup> .....	II-55-C.....	2	2	3	100	Died in 92 hours....	+Type II. Intercurrent illness developed.
2.....	do.....	2	2	3	5,000	Survived.....	
3.....	II-22-C.....	2	2	3	100	Died in 24 hours....	+ <i>Pneumococcus</i> , but a Gram-negative contaminant was also present.
4.....	do.....	2	2	3	1,200	Survived.....	
5.....	do.....	2	2	3	5,000	do.....	
6.....	II-22-F.....	2	3	3	100	do.....	
7.....	do.....	2	2	4	5,000	do.....	
8.....	II-22-O.....	4	2	2	100	do.....	
9.....	do.....	2	2	4	5,000	do.....	
10.....	Control.....				2	Died in 44 hours....	+Type II.
11.....	do.....				20	Died in 75 hours....	

<sup>1</sup> Sick with wasting and skin disease Sept. 17, so given smallest inoculation.

**Vaccine.**—II-55-C was made from a virulent, Type II, 12-hour culture, obtained from the heart blood of a mouse and grown on citrated human blood agar, formalin-killed. II-22-C was prepared in the same manner. II-22-F was prepared in the same way, except that the culture was grown on meat infusion broth to which defibrinated rabbit blood was added. II-22-O was prepared as Vaccine II-22-F, except that it was heat-killed at 55° F. for one-half hour.

**Conclusion.**—Protection obtained against 2,500 lethal doses Type II with formalin-killed and heat-killed vaccines.

Table 20 shows the result of an irregular immunization in rabbits. Vaccines 114A and 114C were highly virulent cultures obtained from the heart blood of a rabbit, incubated 12 hours and killed in 0.2 per cent formalin solution. Vaccine 114A was grown on plain meat-infusion broth; 114 C on the same broth to which had been added sufficient defibrinated rabbit blood cells to make a 1 per cent solution.

These rabbits have been found unsatisfactory for immunization experiments because some of them are incapable of generating antibody responses. The protocol is included only because it shows (1) that the optimum dosage of this vaccine is not the largest dose that can be given, (2) that an immunity against 10,000 lethal doses of Type II *Pneumococcus* is obtainable, and (3) that a broth containing defibrinated blood cells produces a better antigen than the same broth without blood cells.



TABLE 20.—Type II vaccination

Rabbit No.	Weight in grams		Vaccine	Dates of vaccination and organisms (in millions)			Total amount of Type II vaccine (in millions)	Inoculated; amount of Type II Pnc.	Inoculated; amount of Type II	Result and blood culture	Conclusion
	Nov. 12	Nov. 30		Nov. 12	Nov. 17	Nov. 23					
1	270	345	114A	25	25	25	75	Dil. No. 3 (4,000 Pnc.)	Dec. 2	Died in 24 hours (Positive).	No immunity, 1,000 LD.
2	420	502	114A	130	70	100	300	Dil. No. 4 (400 Pnc.)		Survived	Complete immunity, 100 LD.
3	560	685	114C	30	20	25	75		Dil. No. 3 (8,000 Pnc.)	do.	Complete immunity, 100 LD.
4	440	537	114C	40	120	140	300		Dil. No. 2 (80,000 Pnc.)	Died in 30 hours (Positive).	No immunity, 1,000 LD.
5	910	1,076	114A	25	25	25	75		Dil. No. 2 (80,000 Pnc.)	Died in 96 hours (Positive, Type II).	Partial immunity 1,000 LD.
6	790	1,022	114C	20	10	45	75		Dil. No. 1 (800,000 Pnc.)	Survived	Complete immunity, 10,000 LD.
2	Control	257						Dil. No. 6 (4 Pnc.)		Died in 24 hours (Positive, Type II).	No Pnc. in this dilution.
1	Control	227						Dil. No. 7 (0.4 Pnc.)		Survived	1 LD.
1a	Control	234							Dil. No. 5 (80 Pnc.)	Died in 36 hours	Sick for 48 hours. Not a LD.
2a	Control	290							Dil. No. 6 (8 Pnc.)	Survived	No Pnc. in this dilution.
3a	Control	242							Dil. No. 7 (0.8 Pnc.)	do.	

NOTE.—LD signifies lethal doses; Pnc. signifies *Pneumococcus*; dill. signifies dilution.

Vaccines.—Highly virulent, Type II, animal-passage cultures, grown 12 hours (114A on plain meat infusion broth, 114C on the same broth enriched with rabbit cells); formalin-killed.

Summary.—An unsatisfactory experiment because of (a) some rabbits seem incapable of generating an immunity reaction; (b) the animals vary in age and weight. Protocol included because it shows: (1) An irregular immunity, attaining protection against 10,000 lethal doses of Type II *Pneumococcus*; (2) a broth-culture media containing defibrinated rabbit cells produces an antigen superior to one grown in the same broth without the cells; (3) the optimum dosage of *Pneumococcus* vaccine is not the largest amount that can be given; (4) the injection of this vaccine does not interfere with the normal growth of young rabbits.

## DISCUSSION OF TYPE II IMMUNIZATION EXPERIMENTS

These results are to be compared with those of Barach, who obtained protection against 10,000 lethal doses of Type II *Pneumococcus*. He used vaccines in a total dosage of 1,000,000,000 microorganisms administered to mice intraperitoneally, as contrasted with a total of 75,000,000 and 300,000,000 given subcutaneously to rabbits. (Table 20.)

Type II *Pneumococcus* vaccines are less active antigenically than Type I.

## TYPE III IMMUNIZATION EXPERIMENTS

Table 31 shows the result of an experiment in which immunity is conferred against 10 lethal doses; there is no immunity against 50 lethal doses.

Table 32 demonstrates an immunity against 125 lethal doses, resulting from a formalin-killed vaccine (III-79-B) grown on blood broth; there is no immunity against 100,000 lethal doses. Vaccine III-79-F1, which was similar to the preceding vaccine in every respect except that it was grown on defibrinated rabbit-blood agar, protected against 12 but not against 125 lethal doses. Vaccine III-79-F2 was prepared similarly to III-79-F1 in every way except that the microorganisms were killed in 2 per cent formalin instead of 0.2 per cent. The antigenic activity of this latter vaccine is apparently destroyed by the stronger formalin solution.

## COMMENT ON TYPE III VACCINATION EXPERIMENTS

The experimental work on Type III *Pneumococcus* has not been completed.

Although the Type III *Pneumococcus* does not produce as effective antigens as Type I and Type II, vaccines superior to those used in these experiments are to be anticipated.

Since these experiments were made the optimum dosage of *Pneumococcus* vaccine for mice was found to be approximately double the quantity used in experiments 31 and 32. The mouse (No. 3, experiment 32) surviving 125 lethal doses of culture had a slightly larger dosage of vaccine.

TABLE 31.—Type III vaccination

Mouse	Vaccine	Date of vaccination and organisms (in millions)			Inoculation (Type III)	Result	Blood culture
		Aug. 11	Aug. 14	Aug. 17	Aug. 23		
R1.....	53-III.....	2	2	3	5,000	Died in 29 hours.....	+III.
R2.....	53-III.....	2	2	3	500	do.....	+III.
R3.....	53-III.....	2	2	3	100	Survived.....	
R2-B1.....	III-O.....	2	2	3	5,000	Died in 116 hours.....	+III.
R1-B2.....	III-O.....	2	2	3	100	Died in 27 hours.....	+III.
Control red 1.....					12	Died in 35 hours.....	+III.
Control red 2.....					10	do.....	+III.

**Vaccine.**—53-III was made from a 12-hour defibrinated rabbit blood-agar culture, from the heart blood of a mouse, killed in formalin 0.2 per cent in saline, resuspended in same solution after washing once; III-O is a heat-killed vaccine, Type III, 12-hour subculture, of low virulence, grown on blood agar.

**Conclusion.**—(1) Protection against 10, but not against 50 lethal doses of Type III; (2) formalin-killed vaccine is superior to heat-killed.

TABLE 32.—Type III pneumococcus vaccination

Mouse	Vaccine	Dates of vaccination and amounts of organisms (in millions)			Number of Type III inoculated	Result	Blood culture
		Sept. 1	Sept. 4	Sept. 7	Sept. 13		
1	III-28-0.....	2	2	3	5,000	Died in 30 hours.....	Positive.
2	III-79-B.....	2	2	3	500	Survived.....	
3	do.....	2	2	4	5,000	do.....	
4	do.....	2	2	3	400,000	Died in 24 hours.....	Do.
5	III-79-F1.....	2	2	4	500	Survived.....	
6	do.....	2	2	3	5,000	Died in 20 hours.....	Do.
7	do.....	2	2	3	400,000	Died in 24 hours.....	Do.
8	III-79-F2.....	2	2	3	500	Died in 31 hours.....	Do.
9	do.....	2	2	3	5,000	Died in 31 hours.....	Do.
10	do.....	2	2	3	400,000	Died in 20 hours.....	Do.
11	Controls.....				.4	Survived.....	
12					40	Died in 35 hours.....	Do.
13					500	Died in 44 hours.....	Do.

**Vaccines.**—III-28-0, heat-killed subcultured Type III stock strain of low virulence, grown on rabbit blood agar for 12 hours; III-79-B, animal-passage Type III strain of highest virulence grown for 12 hours on blood broth and killed with 0.2 per cent formalin; III-79-F1, same source as III-79-B, except that culture was grown on blood agar and killed with 0.2 per cent formalin; III-79-F2, same as III-79-F1, except that 2 per cent formalin solution was used to sterilize culture.

**Conclusions.**—(1) Protection obtained against 125 lethal doses Type III; (2) formalin-killed vaccine superior to heat killed; (3) 2 per cent formalin destroys antigenic properties.

#### MIXED VACCINATION EXPERIMENT

Table 17 shows that an immunity protecting against 20 lethal doses of Type II *Pneumococcus* results from a vaccine containing Types I, II, and III *Pneumococcus*.

The Type II vaccine used in this experiment had rather low antigenic powers. It was used in the same dosage in the experiment recorded in Table 16 and failed to protect against 20 lethal doses. The fact that an interval of 13 days elapsed between the last vaccination and the inoculation in Table 17, while the interval was 6 days

in Table 16, is of slight importance as it is thoroughly established (Armstrong, Barach) that protective substances are present on the third day, following the injection of vaccine, and that they attain maximum concentration on the fifth day.

This experiment, if confirmed, would substantiate the findings of Tillett and of Julianelle that some degree of cross protection is conferred by heterologous *Pneumococcus*.

TABLE 17.—*Mixed vaccination (Types I, II, and III) vaccines I-51, II-55, III-53*

Mice	Date vaccinated, and millions of each vaccine			Inoculated Type II	Result	Blood culture	Conclusion
	Aug. 12	Aug. 14	Aug. 17	Aug. 30			
1	2	2	3	10,000	Died in 28 hours.....	Positive.....	Immunity, none. Immunity, slight. Immunity, complete.
2	2	2	3	1,000	Died in 68 hours.....	do.....	
3	2	2	3	100	Survived.....	do.....	
4	Control.			5	Died in 30 hours.....	Positive.....	
5	Control.			10	Died in 34 hours.....	do.....	
6	Control.			100	Died in 30 hours.....	do.....	

All vaccines are made from formalin-killed, highly virulent, animal-passage cultures grown on defibrinated blood agar.

*Conclusion.*—The mixed vaccine protected against 20 lethal doses of Type II *Pneumococcus*.

#### THE ROUGH STRAIN PNEUMOCOCCUS

Griffith (1923) discovered in subcultures a strain of *Pneumococcus* which is avirulent and nontype specific. This strain grows on solid culture media in colonies having rough irregular outlines in contrast to the smooth colonies of the virulent pneumococcus. It was designated the "rough" or "R" strain in contradistinction to the "smooth" or "S" strain of the virulent, type-specific pneumococcus.

Dawson (1928) demonstrated the interconvertibility of the R and S forms.

Tillett (1927 and 1928) vaccinated rabbits with 18 intravenous injections of a vaccine made from an R strain derived from an S Type II *Pneumococcus* and demonstrated a broad general immunity against virulent cultures of Types I, II, and III *Pneumococcus*. The total dosage of vaccine used was about 40,000,000,000 pneumococci for each rabbit.

Julianelle (1930) demonstrated an immunity in rabbits against the intravenous injection of 1,000,000 lethal doses of virulent Type I *Pneumococcus* by the intradermal injection of a vaccine made from an R strain derived from an S Type II. A total of 20 cubic centimeters of antigen was given each rabbit; each cubic centimeter of antigen was the equivalent of 10 cubic centimeters of *Pneumococcus* culture. (Each cubic centimeter of *Pneumococcus* culture contains about 500,000,000 organisms.)

TABLE 51.—*Rough strain vaccination*

	Date of vaccination and number of organisms (in millions)			Inoculated	Result	Blood culture	Comment
	June 28	July 1	July 4	July 8			
1	2	1	4	4,000, Type I.....	Died in 22 hours.....	+I	No immunity.
2	2	1	4	40,000, Type I.....	Died in 20 hours.....	+I	Do.
3	2	1	4	80,000, Type I.....	Died in 20 hours.....	+I	Do.
4	2	1	4	120,000, Type I.....	Died in 22 hours.....	+I	Do.
	Controls.			4,000, Type I.....	Died in 22 hours.....	+I	
				10, Type I.....	Died in 28 hours.....	+I	

*Vaccine.*—Described in Table 52.

*Summary.*—A vaccine made from a rough strain *Pneumococcus* does not protect against 400 lethal doses of Type I *Pneumococcus*. This is to be contrasted with complete protection against 40,000 lethal doses resulting from a vaccine made from highly virulent Type I *Pneumococcus* and given in a slightly smaller total dosage (Table 3) but with a longer interval between the final vaccine injection and the inoculation.

TABLE 52.—*Rough strain vaccination*

Mouse	Date of vaccination and number of R strain injected (in millions)			Inoculated (Type I)	Result	Post-mortem blood culture
	July 13	July 16	July 20	July 25		
1	1.5	2.0	2.5	5,000,000	Died in 24 hours.....	Positive.
2	1.5	2.0	2.5	50,000	Died in 41 hours.....	Positive 1.
3	1.5	2.0	2.5	5,000	Survived.....	Do.
4	1.5	2.0	2.5	500	Died in 29 hours.....	Do.
5	1.5	2.0	80.0	5,000,000	Died in 24 hours.....	Positive.
6	1.5	2.0	80.0	50,000	do.....	Do.
7	1.5	2.0	80.0	5,000	Died in 33 hours.....	Positive 1.
8	1.5	2.0	80.0	500	Died in 63 hours.....	Do.
Control 1.....				5,000	Survived.....	
Control 2.....				10	do.....	

*Vaccine.*—A 20-hour culture of an R strain *Pneumococcus* derived from an S Type II, grown on defibrinated rabbit-blood agar; heat-killed at 55° F. for one-half hour.

*NOTE.*—This experiment to be confirmed.

*Conclusion.*—In the dosages given above this vaccine rendered mice susceptible to this avirulent inoculation.

## COMMENT

The species specific immunity induced by the R forms of *Pneumococcus* in animals, as contrasted with the essentially type-specific immunity resulting from the S strains, offers many interesting possibilities.

The great disadvantage to their use in humans would be the large amounts of antigen required.

Tables 51 and 52 substantiate Tillett's findings that large quantities (greater than 25,000,000,000 pneumococci) of antigen are required. The experiment in Table 52 should be repeated, as it shows that animals are made hypersusceptible to *Pneumococcus* following vaccination with small quantities of vaccine made from R forms of *Pneumococcus*.

THE POSSIBILITIES OF EFFECTIVE PNEUMOCOCCUS VACCINATION  
OF NAVY PERSONNEL

The fixed-type pneumococci cause about 67 per cent of the cases of lobar pneumonia and about 21 per cent of the cases of broncho-pneumonia in the United States.

## LOBAR PNEUMONIA

The United States Navy pneumonia morbidity experience for the past five years shows than an average of 220 cases of lobar pneumonia occur each year. An effective vaccine, containing only Types I, II, and III pneumococci, would reduce the average number of cases to 73 per year; and the average sick days per year would be reduced from 8,869 to 2,936.

Should the Navy experience prove to be similar to that of Cooper (1929) who found that five strains of Group IV pneumococci are the cause of 60 per cent of the Group IV lobar pneumonias, a further reduction in incidence could be expected from the inclusion of these strains in the vaccine.

Effective vaccination in which Group IV organisms are included would reduce the 73 expected cases to 29 cases and the sick days from 2,936 to 1,174.

## BRONCHO-PNEUMONIA

The average number of cases of broncho-pneumonia occurring each year in the Navy is 177. Effective vaccination against fixed types only would reduce this number to 139, and the sick days would be reduced from 6,260 to 4,945.

To summarize the maximum possible results of effective *Pneumococcus* vaccination on combined pneumonia morbidity: The total number of cases of pneumonia would be reduced from 397 per year to 168 per year if the vaccine was 100 per cent effective; if the vaccine was 50 per cent effective the number of cases would be reduced from 397 to 229. The number of sick days per year would be reduced, according to the effectiveness of the vaccine, from 15,129 to 6,119 and 11,124, respectively.

The incidence of pneumonia should be further reduced in a satisfactorily vaccinated personnel by the following facts:

(1) That Type I infection occurs more frequently in young adults, and the injection of an active Type I *Pneumococcus* vaccine is followed by a most satisfactory immunity response.

(2) That fewer contacts would result from a reduction in the number of cases of pneumonia.

(3) That fewer cases of broncho-pneumonia should occur if the predominating strains of Group IV pneumococci were included in the vaccine.

(4) That some degree of cross protection or nonspecific immunity is to be anticipated.

Any cases of pneumonia occurring among a vaccinated personnel would pursue a milder course and have fewer sick days. (Cecil and Steffens, 1922; Von Sholly, 1923; Table 12.)

TABLE 42.—*Lobar pneumonia*

## ENTIRE NAVY

	1924	1925	1926	1927	1928	Total	Average
Total cases.....	246	219	179	215	241	1,100	220
Admission rate per 1,000.....	2.06	1.90	1.57	1.86	2.08	9.47	1.89
Case fatality rate per 100.....	11.4	9.1	7.8	10.7	19.5		
Total sick days.....	9,340	10,241	7,551	7,253	9,960	44,345	8,869

## ENLISTED MEN, NAVY (EXCLUSIVE OF MARINES)

	1924	1925	1926	1927	1928	Total	Average
Total cases, all ages.....	216	162	116	139	140	773	154
Admission rate per 1,000.....	2.47	1.92	1.39	1.64	1.65	9.07	1.81
Cases in age group, 16 to 19 years.....	52	29	25	47	45	198	39.6
Admission rate per 1,000.....	4.67	3.03	2.70	3.53	3.34	17.27	3.45

TABLE 43.—*Broncho-pneumonia*

## ENTIRE NAVY

	1924	1925	1926	1927	1928	Total	Average
Total cases.....	109	111	122	324	206	894	177
Admission rate per 1,000.....	.91	.96	1.07	2.90	1.79	7.63	1.55
Case fatality rate per 100.....	10.1	9.0	12.3	11.1	17.3		
Total sick days.....	4,489	4,114	4,229	11,191	7,279	31,302	6,260

## ENLISTED MEN, NAVY (EXCLUSIVE OF MARINES)

	1924	1925	1926	1927	1928	Total	Average
Total cases, all ages.....	86	64	61	114	96	421	84
Admission rate per 1,000.....	.98	.76	.73	1.35	1.13	4.95	.99
Cases in age group 16 to 19 years.....	19	13	10	34	26	102	20
Admission rate per 1,000.....	1.71	1.36	1.08	2.55	1.93	8.63	1.73

## COMMENT

The records of the Bureau of Medicine and Surgery show that the *Pneumococcus* infections developed by recruits occur relatively infrequently at the naval training stations, and most frequently when the recruits are sent to sea. These figures, while an excellent commentary on the satisfactory hygienic conditions existing at the naval training stations, emphasize the undesirable effects of the unavoidable crowding which exists on the man-of-war. From a

military standpoint there exists, under present conditions, this factor tending to produce military ineffectuals where they are least desirable. To this is added the danger of the increased possibilities for infection of contacts from the presence of a readily transmissible disease.

Tables 42 and 43 show that the average rate per 1,000 of lobar and broncho pneumonia in the age group of 16 to 19 years, enlisted men, Navy, averages almost twice the rate for the total enlisted men, Navy. This reaffirms the opinion, generally held, that the recruit from a rural community has not had the *Pneumococcus* immunity resulting from contact with carriers. Cecil and Austin's statistics also show a much higher incidence to occur in recruits than in veteran troops.

Because of the increased incidence of lobar pneumonia in this 16 to 19 year age group, vaccination of all recruits for two years should reduce the number of cases of lobar pneumonia occurring in this age group from 39.6 per year to 5.2 cases per year. A 2-year experience would establish the accuracy of this premise.

The duration of immunity following *Pneumococcus* vaccination is unknown, although it is generally thought to be of short duration. Goodner (1928) working in Zinsser's laboratory believed the immunity to last only a few months. Zinsser, from his extensive experience in *Pneumococcus* research, holds a similar belief (1930).

Nevertheless, Lister (1917 report) shows that the immunity in a human, as gaged by the agglutinin titer and by the opsonic index, attains its maximum in four months, falls one-third by the sixth month, and then strikes a level which remains unchanged through the ninth month. In Lister's Crown Mine experiment the immunity was shown to exceed nine months' duration. Von Sholly and Park demonstrated an immunity exceeding six months.

The work of Ross (1926, 1927, and 1930) indicates that the duration of the immune phase following *Pneumococcus* vaccination would be prolonged if the products of bacterial growth (the hypothetical exotoxin) were included with the vaccine. Unfortunately, these products cause very rapid autolysis of the *Pneumococcus*.

*Constitutional reactions.*—The experience of Cecil and Austin is a fair criterion. Using subcutaneous doses of 3, 6, 5½, and 5½ billion organisms they report that among 12,510 men receiving 4 inoculations, painful local reactions occurred in 152 (1 in 82) and a general reaction necessitating absence from duty occurred 25 times (1 in 500).

Von Sholly and Park record that 87 persons among 1,536 inoculated lost a total of 181 days as a result of the vaccination. They note that some people would take advantage of the inoculations to remain at home because of illness insurance.



*Loss of time to personnel receiving vaccination.*—The relative mildness and infrequency of reactions to *Pneumococcus* vaccination would warrant the injection being made at the same time (using preferably the other arm) as the typhoid immunization.

#### SUMMARY

Active immunity, by subcutaneous injection of killed *Pneumococcus* suspensions, has been developed regularly in white mice and rabbits against 100,000 lethal doses of Type I *Pneumococcus*; against 2,500 lethal doses of Type II *Pneumococcus*; against 125 lethal doses of Type III *Pneumococcus*.

This immunity is effective against intraperitoneal and intratracheal injection of homologous *Pneumococcus*; the immunity is essentially type specific.

*Pneumococcus* vaccines made from cultures obtained from the heart blood of inoculated animals do not have antigenic powers superior to vaccines made from subcultures of equally high virulence.

Formalin-killed *Pneumococcus* vaccines are but very slightly superior to heat-killed vaccines.

Killed pneumococci in vaccines tend to autolyze into Gram-negative amorphous debris. The most effective of the methods employed for limiting autolysis was found to be repeated washings of the microorganisms.

A vaccine containing morphologically intact organisms is essential; Gram-negative, autolyzing *Pneumococcus* debris has no antigenic power.

Certain batches of *Pneumococcus* vaccine may have no antigenic powers, though similarly prepared to vaccines which are active antigenically.

Type I *Pneumococcus* cultures produce maximum antigenic powers after 18 hours incubation; Type II after 12 hours incubation; Type III after 6 to 8 hours incubation.

Vaccination with rough strain *Pneumococcus* in total dosages of 80,000,000 organisms did not confer any appreciable degree of immunity against Type I infections.

The immunity against homologous *Pneumococcus* is augmented by the presence of heterologous strains of *Pneumococcus* in the vaccine.

#### SCHEDULE OF PROPOSED INVESTIGATIONS

1. Vaccination of five human volunteers with a vaccine, proven to be an active antigen, containing Types I, II, and III, in dosages of 150,000,000 of each type, given at weekly intervals, and the determination of the degree of the resulting immunity by animal protec-

tion experiments,<sup>1</sup> (a) before vaccination, (b) 1 week, 1 month, 3 months, 6 months, 9 months and 12 months after vaccination.

2. Human experiments to determine the optimum dosages of the vaccine on five additional human volunteers.

3. Experiments to attempt to raise the degree of immunity in animals conferred by Types II and III vaccines by (a) repeatedly passing the pneumococcus through mice rendered hyper-susceptible (b) using culture media consisting principally of rabbits' blood,<sup>2</sup> (c) increasing the dosage of the vaccine to the optimum.

4. Investigation to determine the desirability of including in the vaccine the four strains of Group IV *Pneumococcus* which have been found to cause 60 per cent of the Group IV lobar pneumonias.

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<sup>1</sup> The measure of the degree of immunity by determining the agglutination titer or the opsonic index is unsatisfactory. It is known (Butler) that the immunity against typhoid infection continues after the blood serum has lost the power of agglutination. The agglutinins are merely one element of the entire immunity response.

Tillett (1928) demonstrated active resistance against Type III *Pneumococcus* in the blood sera of animals immunized by *R Pneumococcus*, although the sera contained no type specific antibodies capable of agglutinating Type III *S Pneumococcus*, nor did the sera contain precipitating soluble specific substance derived from Type III cultures, nor was the sera capable of conferring passive protection against Type III infection.

<sup>2</sup> The experience of the past two years has shown that the conventional culture media are essentially unsatisfactory. Investigations are now being made of culture media consisting basically of hemolized, defibrinated rabbit blood cells.

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## THE VENEREAL-DISEASE PROBLEM IN THE UNITED STATES

### PART I. CIVILIAN AND MILITARY METHODS OF PREVENTION AND CONTROL, WITH A COMPARATIVE STATISTICAL RÉSUMÉ OF VENEREAL INCIDENCE IN THE SOUTH CHINA PATROL FOR 1929 AND 1930

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Clinical data collected over a period of 18 months in the South China patrol form the basis of this paper dealing with the general venereal-disease problem. Its sequel, to be published later, will review modern treatment methods in acute gonorrhea and present a comparative survey of 52 consecutive cases.

## THE PUBLIC-HEALTH VIEWPOINT

(A) *The venereal-disease problem in a military organization—The United States Navy.*—The problems of prevention, control, and treatment of venereal disease are of outstanding importance in any military organization. They relate fundamentally to the intangible factor of morale, they have to do with the real and substantial economic waste of incapacitation and disability, they are too often the deciding factor between organizational mediocrity and fleet efficiency.

The broad general facts relative to venereal-disease incidence in the United States Navy are these (1) (2) :

The venereal-disease admission rate (incidence) for the entire Navy in 1929 was 127.51 per 1,000 of total personnel—an increase of 2.74 per cent over 1928. Total admissions in 1929 (all reported cases of gonorrhea, syphilis, and chancroidal infections) were 14,968, representing a total of 204,110 sick days. The incidence of gonorrhea was 3.86 per cent greater than for the previous year, and was directly related to increased admissions in the Asiatic Fleet, forces in China, the Philippines, Nicaragua, Panama, and shore activities in the United States (2). The noneffective rate from all forms of venereal disease (daily average number of persons on the sick list per 1,000) was 4.76. The age group 20 to 24 showed the highest admission rates except in the case of syphilis where the highest incidence was in the group 25 to 29.

The total number of cases of gonorrhea treated during the year was 9,205, the highest since 1925. Seventy-nine and eleven one-hundredths per cent of these (6,943) were admitted for record only with no sick days. The admission rate per 1,000 was 74.76, total sick days 121,585, and the noneffective rate per 1,000, 2.84. The ratio between cases of syphilis and cases of gonorrhea was 1 to 3.5 (2).

In this connection it is interesting to note that a review of admissions to hospital in the British Navy (1929) shows a venereal-disease admission rate of 73.74 per 1,000, a disability loss to the service of 130,041 days and an average number of men sick daily of 356.25 (9).

(B) *The Asiatic Fleet.*—The venereal-disease incidence in the Asiatic Fleet is interesting from a comparative standpoint. There were 3,327 admissions in 1929—a rate of 454.57 per 1,000. Among the larger vessels an increase of 52.79 per cent was recorded above the 1924–1928 average; the destroyer squadrons showed a 9.4 per cent decrease; the miscellaneous vessels had total admissions of 1,041, a rate of 411.79, an increase of 17.62 per cent over 1924–28. The ratio of syphilis to gonorrhea was 1 to 4 (2).

The venereal-disease incidence in the Asiatic Fleet, therefore, constituted 22.2 per cent of the total admissions in the Navy and the rate was 3.56 times that of the Navy as a whole.

It is noteworthy that the fluctuating noneffective rate of the service as a whole is largely attributable to the varying proportion of infections contracted in the Asiatic and other foreign ports where there is unrestricted prostitution and sale of alcoholic beverages (2).

(C) *The South China patrol* (U. S. S. "Mindanao" and U. S. S. "Helena").—In his annual report for the fiscal year 1930, the Surgeon General of the Navy has stressed the salient and pertinent fact that considerable fluctuation in admission rates may occur from year to year, particularly in organizations having small personnel and actually few cases. Obviously under these circumstances, an increase or decrease in a few cases numerically will make large percentage differences in the rates, and consequently materially affect the value of such rates in an expectancy forecast (2).

In spite of this fact, a statistical study of venereal-disease incidence in the South China patrol for 1929 and 1930 was conducted with the purpose of establishing a general norm for future expectancy, of defining the proper objective for further preventive measures, and of making some highly interesting comparisons with the venereal-disease incidences in the Asiatic Fleet and the Navy as a whole.

The total venereal-disease admission rate per 1,000 in the South China patrol for 1929 (Table 1) was 627.04—an increase of 52.27 per cent above the 1929 rate (411.79) for the Asiatic Fleet (miscellaneous vessels), and almost five times the rate for the Navy as a whole.

In 1930 the total admission rate was 545.87 per 1,000—a decrease of 12.94 per cent compared with the 1929 rate for the South China patrol, representing an actual numerical decrease of 34. At the same time the Asiatic Fleet (miscellaneous vessels) and the whole Navy showed percentage increases of 14.6 and 5.02 per cent respectively over their 1929 rates.

In 1929 the patrol admission rate for gonorrhea per 1,000 (Table 2) was 315.57; in 1930 it was 220.18—a percentage decrease of 30.23 per cent.

The admission rate for syphilis for the patrol in 1929 was 81.96 per 1,000; in 1930, 105.5—a percentage increase of 28.72 per cent. The ratio of syphilis to gonorrhea in 1929 was 1 to 3.8; in 1930, 1 to 2.09.

The patrol admission rate for chancroid in 1929 was 229.51; in 1930 it was 220.18 per 1,000—a percentage decrease of 4.07 per cent.

The tabulation of comparative numerical admissions is of considerable interest. (Table 3.)

In 1930 there were 29 less admissions for gonorrhea than in 1929—a decrease of 37.66 per cent as compared with a decrease of 1.33 per cent in the Navy as a whole.

TABLE 1.—*Total venereal disease admission rates, South China patrol, Asiatic Fleet (miscellaneous vessels) and whole Navy (1929-1930), all three diseases*

Ship	1929				1930			
	Average strength	Admissions	Admission rate per 1,000	Per cent above or below 1929 rate Asiatic Fleet (miscellaneous vessels)	Average strength	Admissions	Admission rate per 1,000	Per cent above or below 1929 rate
U. S. S. Mindanao.....	64	31	484.37	+17.63	74	35	472.97	-2.35
U. S. S. Helena.....	180	122	677.77	+64.59	144	84	583.33	-13.93
Total South China patrol	244	153	627.04	+52.27	218	119	545.87	-12.94
Asiatic Fleet (miscellaneous vessels)	2,528	1,041	411.79	+17.62	2,369	1,118	471.93	+14.60
Total all Navy and Marine Corps.....	117,388	14,968	127.51	+2.74	117,453	15,728	133.91	+5.02

<sup>1</sup> 1924 to 1928 average.

<sup>2</sup> 1928.

TABLE 2.—*Comparative venereal disease admission rates, South China patrol for 1929 and 1930, showing ratio of admissions from syphilis to admissions from gonorrhea*

Ship	Gonorrhea				Syphilis				Chaneroid		
	Average complement	Admissions	Admission rate per 1,000	Percentage above or below 1929 rate	Admissions	Admission rate per 1,000	Percentage above or below 1929 rate	Ratio syphilis to gonorrhea	Admissions	Admission rate per 1,000	Percentage above or below 1929 rate
1929											
U. S. S. Mindanao.....	64	19	296.88	-----	3	46.87	-----	1-6	9	140.63	-----
U. S. S. Helena.....	180	58	322.22	-----	17	94.44	-----	1-3.4	47	261.11	-----
Total South China Patrol.....	244	77	315.57	-----	20	81.96	-----	1-3.8	56	229.51	-----
1930											
U. S. S. Mindanao.....	74	16	216.22	-27.17	12	162.16	+245.98	1-1.3	7	94.59	-32.74
U. S. S. Helena.....	144	32	222.22	-31.03	11	76.38	-19.12	1-2.9	41	284.72	+9.04
Total South China Patrol.....	218	48	220.18	-30.23	23	105.50	+28.72	1-2.09	48	220.18	-4.07

**TABLE 3.**—*Comparative numerical admissions from venereal disease for South China patrol (1929 and 1930), Asiatic Fleet (miscellaneous vessels) and total Navy, showing numerical percentage increases and decreases*

Ship	Gonorrhea				Syphilis			
	Admissions		Numerical increases or decreases <sup>1</sup>	Numerical percentage increases or decreases <sup>1</sup>	Admissions		Numerical increases or decreases <sup>1</sup>	Numerical percentage increases or decreases <sup>1</sup>
	1929	1930			1929	1930		
U. S. S. Mindanao.....	19	16	—3	—15.79	3	12	+9	+300
U. S. S. Helena.....	58	32	—26	—44.8	17	11	—6	—35.3
Total South China patrol..	77	48	—29	—37.66	20	23	+3	+15
Total all Navy and Marine Corps.....	8,776	8,659	—117	—1.33	2,540	2,940	+400	+15.75

Ship	Chancroid				Totals			
	Admissions		Numerical increases or decreases <sup>1</sup>	Numerical percentage increases or decreases <sup>1</sup>	Total admissions		Numerical increases or decreases <sup>1</sup>	Numerical percentage increases or decreases <sup>1</sup>
	1929	1930			1929	1930		
U. S. S. Mindanao.....	9	7	—2	—22.22	31	35	+4	+12.90
U. S. S. Helena.....	47	41	—6	—12.76	122	84	—38	—31
Total, South China patrol..	56	48	—8	—14.29	153	119	—34	—22.22
Total Asiatic Fleet (miscellaneous vessels).....					1,041	1,118	+77	+7.4
Total all Navy and Marine Corps.....	3,652	4,113	+461	+12.62	14,968	15,728	+760	+5.08

<sup>1</sup> Compared with 1929.

There was an increase of three admissions for syphilis in the patrol over 1929—an increase of 15 per cent as compared with an increase of 15.75 per cent for the entire Navy.

There were eight less admissions for chancroid in 1930—a decrease of 14.29 per cent while the Navy as a whole increased 12.62 per cent.

Total venereal-disease admissions for 1930, all three diseases, showed a decrease of 34—a percentage decrease of 22.22. This compares favorably with the increase of 77 in the Asiatic Fleet (miscellaneous vessels), a 7.4 per cent increase, and with the increase of 760 for the Navy as a whole, a 5.08 per cent increase.

It is true that these data serve admirably to demonstrate how large, disproportionate fluctuations in percentage may result from small actual numerical variations. Nevertheless, they make possible the assignment of a general expectancy value for each disease, and definitely point out the necessity for vigorous and forceful anti-syphilitic measures. In fact, the increase of nine admissions for syphilis in 1930 over 1929 aboard the U. S. S. *Mindanao* is ascribable solely and simply to slipshod prophylactic measures employed by very young, carefree, first-cruise men, who, in spite of repeated warn-

ings as to the dangers and instruction in proper prophylactic methods, together with rigorous follow-up of reported exposures, failed to take the proper precautions.

#### THE VENEREAL-DISEASE PROBLEM IN CIVILIAN LIFE

(A) *The medical revolution.*—What are the significant features of the venereal-disease problem in civil life?

It is essential at the outset to recognize the fact that the problem of prevention and control of venereal disease among the civilian population is best regarded as a phase of the unmistakable evolutionary trend in modern medicine toward centralization—toward a possible eventual State medicine. What fundamental forces activate this major movement, and what does it signify?

In his scholarly address on the medical revolution before the American College of Surgeons in October, 1929, President Frank, of University of Wisconsin, ably summarized the basic factors, citing (a) the dehumanizing influence of the entry of the science of medicine into the field of the art of medicine; (b) the increasing public interest in the prevention of disease and the "social passion" of society to rid itself of the waste and inefficiency due to disease, which has found practical expression in the corporate medical activities of great industries, and the rapid development of disease-prevention and life-prolongation programs by big insurance companies (7). In this connection, (c) the dissatisfaction of the patient with the rising cost of medical care and its economic counterpart—the inadequate compensation of the average practitioner for his services—may be regarded as symptoms of inherent economic maladjustment—potent factors in the prevailing discontent with the status quo.

Although favoring internal control of the fundamental social service rendered by medicine, President Frank is concise and explicit in his warning to the profession that "unless adequate medical statesmanship is brought to the direction of the present medical revolution by the men now in the profession \* \* \* it may happen that a vast high-powered medical machine under the sponsorship of industries, insurance companies, and governments will enter the field and subject the private practitioner of medicine to a ruinous competition" (7).

How does the problem of venereal-disease prevention and control relate itself to this fundamental tendency in modern medicine?

As is the case in medicine in general, "the trend of successful venereal-disease control as a world movement is \* \* \* unmistakably organizationward" (11). Some years ago Stokes pointed out the possibility that the general practitioner might be displaced in the treatment of venereal disease, due to negligence, inadequacy, and lack of system. In his recent important paper (11) he notes the



introduction of big business methods into and the commercialization of certain municipal venereal-disease clinics. Obviously, the venereal-disease problem simply mirrors the more general trend.

(B) *Incidence and prevalence in the civilian population.*—According to the terminology of public-health statistics, “prevalence” indicates the total number of cases on a given day; “incidence” means the total number of cases in a year.

In a recent excellent statistical study of venereal-disease prevalence and incidence in the United States (12) with the object of establishing a basis for future determination of the effectiveness of present-day control efforts, Usilton draws some very interesting conclusions. On the basis of data collected in a survey of 25 communities throughout the United States with a population of 24,500,000 persons, it was estimated that there were 643,000 cases of syphilis and 474,000 cases of gonorrhea constantly under medical care in the United States. (Prevalence.)

The annual attack rate (incidence) of syphilis and gonorrhea was estimated on the basis of the incidence found in a city of 2,000,000 inhabitants. It was estimated that 423,000 new cases of syphilis seek treatment every year in the United States during the early stage (first year) of the disease and that 679,000 new cases of gonorrhea come under medical care during the first three months of the infection. (Incidence.) This incidence represents an annual attack rate per 1,000 population of 3.46 for syphilis and 5.71 for gonorrhea as a minimum (12).

Previous studies by the Public Health Service found that the gonorrhea rate was higher in the ages 20 to 24 than syphilis, but from 35 years on the ratio was considerably higher for syphilis (12).

A recent survey of New York State (10) discloses that in up-State New York over 15,000 cases of syphilis and nearly 11,000 cases of gonorrhea are constantly under treatment (prevalence), and that approximately 25,000 new cases of syphilis and 40,000 of gonorrhea are diagnosed each year. There was no decline in the prevalence rate of gonorrhea between 1927–1930, but the number of cases of syphilis increased by nearly 3,000 (5A). A greater prevalence of venereal diseases exists among the negro than the white population in the United States generally, 8 for the white and 11 for the colored per 1,000 population (8).

Clark (5) found the highest white prevalence rates of all surveyed localities in Charleston, W. Va.—52.8 for syphilis and 65.8 for gonorrhea.

(C) *Are venereal diseases on the increase?*—What is the true trend of venereal disease rates among the civilian population? No absolute and definite information on this important point is available, but Clark (5A) states that syphilis is certainly on the increase

and there is no improvement in the gonorrhea rate in New York State; and that although general actuarial statistics show a steady decline in syphilis death rates among the white population since 1918, there has been a pronounced upward tendency in the syphilitic death rate among negro males (9.79 per 1,000). Although no increase in the gonorrhea rate can be predicated, it is improbable that there is any tendency to decline.

(D) *Social and economic consequences.*—The tremendous social and economic implications of this fearful invasion are realized among all classes in the tragedy of congenital syphilis, in the lowered physical and mental efficiency of large numbers of the populace, in the enormous toll of suffering from its complications, in the staggering loss of working time, and in the great cost of charitable and institutionalized medical care (5A) (7). It is important to recognize that syphilis alone is responsible for 43 per cent of premature infant mortality, 9 per cent of defective mentality in school children, 10 to 15 per cent of the total blind, 11 to 25 per cent of all organic heart disease, and 9 per cent of all insanity (5A).

Frank (7) has estimated an annual loss of 350,000,000 working days from disease in general, and calculates the annual economic loss due to preventable disease and postponable death to be \$1,800,000,000—a charge borne by the gainfully employed.

In their survey Parran and Usilton (8) estimate the number of effective days lost through venereal disease among the general male population between the ages of 15 and 45 at 21,000,000 days, or 6 per cent of the total annual loss in working time.

(E) *Comparison between civilian and military rates.*—In any statistical comparison between civilian and military venereal disease rates it must be clearly understood that (a) in a military organization we are dealing for all practical purposes with a selected age and sex group, small numerically relative to the general population, which corresponds to and includes the ages of greatest sexual activity and hence greatest potential and actual venereal infection; (b) this selected age group is subjected to constant medical scrutiny and inspection—concealment is almost impossible—the reporting of all cases is required, so that prevalence and incidence statistics are very close to the actual facts, rather than as in civilian estimates, a minimum conjecture.

The minimum estimated annual attack rate in the civilian population per thousand was 3.46 for syphilis and 5.71 for gonorrhea (12); the admission rate per 1,000 in the United States Navy for 1929 was 21.64 for syphilis and 74.76 for gonorrhea. Superficially the discrepancy in individual rates might appear irreconcilable. It must be remembered, however, that immediate statistical comparison is not possible—the relative differences between the two groups are too

great; on the one hand we have a diverse population of 120,000,000 comprising both sexes, all ages, classes, occupations, without anything approaching organized control; on the other we have a highly integrated military organization of 117,000, a selected sex and age group subject to definite supervision and control.

Although not susceptible of actual absolute proof it is felt that venereal-disease rates in the United States Navy exceed very little if at all those that would prevail in an exactly comparable civilian group similarly organized and exposed.

#### METHODS OF PREVENTION AND CONTROL

(A) *Civilian measures.*—Consonant with the trend of the times, the control of venereal disease is at once the despair and the opportunity par excellence of preventive medicine. Greatest reliance is placed on three major measures: Educational, law enforcement, and medical (5A).

(1) Education of the public in these matters is an important function of the health authorities. The individual efforts of private physicians in instructing their patients and communities concerning the personal and social dangers, the need for adequate treatment, and the precautions against spread of infection are of tremendous value (5A).

Sex hygiene is probably best taught in the home supplemented by advice to individual children by properly trained teachers. In the case of adults, illustrated lectures are recommended (5A).

(2) Law enforcement, and enforcement legislation do not offer a final solution, but are of distinct value in the control of individuals refusing treatment or knowingly communicating disease. The crying need is the establishment of an adequate organization and facilities for treatment of necessitous cases and vigorous follow-up of lapsed treatment (5A).

The recent German law, reprinted in full in Butler's article (3) is an excellent example of benevolent paternalism applied to the solution of the venereal-disease problem.

Prenuptial medical examination has been made prerequisite to obtain a marriage certificate in a number of countries, a provision which is being regarded with increasing favor in the United States. Twelve States already require such an examination (5A).

Of interest in this connection is the splendid experiment in social medicine being carried out by the division of venereal diseases of the British Ministry of Health under Colonel Harrison. Following a policy of humanity and voluntarism rather than mechanistic routinization and law-enforced compulsion, a reduction of five-sixths in the incidence of new infections with syphilis was effected (1925-26 cf. 1918) (11).

(3) Medical control of venereal disease predicates a proper co-operation between the clinic, the public-health officials, and the private physician.

The private physician is still an important factor in venereal-disease control. It has been found that 31 per cent of all venereal cases are charity cases and treated at public expense. The remaining 69 per cent are private patients; 21 per cent of all cases of gonorrhea and 40 per cent of cases of syphilis are treated in public clinics (5A).

In his excellent survey Clark (5A), inveighs strongly against the prevalent inefficiency in the treatment of syphilis, due to inadequate training of the general practitioners, the dilatory attitude of the patient, and incomplete follow-up service in this regard. He stresses the highly significant fact that the mucosal and cutaneous relapses in early syphilis are far more serious as a public-health problem than the primary chancre, because such lesions are easily overlooked and their infectious character unrecognized.

Crabtree (6) touches on the same problem in one of our most enlightened States, and finds that most private practitioners treat venereal disease, but few desire to and would prefer to refer them to specialists if more were available; that the necessity of prolonged treatment must be brought home to the patient; that further provision for indigents must be made; that there is a definite expressed need among physicians for further training at demonstration clinics.

Prophylaxis is an important element in the medical phase of control, and at one time was regarded as the panacea. But in order to be effective there must be actual and definitive control of the clientele as in the military services. Replies to a recent questionnaire addressed to all State health officers and 14 leading commissioners show abandonment of established prophylactic stations due to poor patronage. The present consensus of opinion is that chemical and mechanical prophylaxis as a public health measure can not be successfully carried out in civil life (5A).

(b) *Methods in a military organization (United States Navy).*—Disciplinary control, inherent in the nature of the organization, is the least common denominator of the venereal-disease problem in the naval service, and the results obtained are directly proportional to the humane understanding and intelligent cooperation with which it is applied.

The available measures for control naturally closely parallel those operative in civil life and include educational and morale, disciplinary and regulational, and medical methods.

(1) Educational and morale methods: This group naturally comprises such preventive measures as lectures to the men by medical officers, venereal posters, educational movies, and the like (2).

Proper tactful approach and chats with individuals have been found of great value, particularly in the case of young first-cruise men in localities with a high exposure hazard, who are thrown with terrific suddenness on their own responsibility. Without derogation to the rest of the enlisted personnel it is felt that it is in this group (first-cruise men) that the preventive advice of the medical officer is most effective.

The encouragement of athletics has always been a potent factor in morale. The fleet surgeon, Asiatic Fleet, has enthusiastically indorsed the establishment of the Asiatic Fleet athletic fields at Manila, P. I., as providing extensive athletic facilities that will be indirectly effective in reducing venereal-disease incidence (1).

As a supplementary measure, it has been found effective, where possible to secure the cooperation of civilian authorities, to take selected groups of men to civilian hospitals to observe certain outstanding examples of the ravages of venereal disease.

(2) Disciplinary and regulational: In addition to the broad provisions set forth in the United States Navy Regulations, the manual of the medical department, general orders, and circular letters, these include such measures as: (a) Periodic surprise venereal inspection to detect concealment; (b) admission to sick list and pay checkage; (c) placing on venereal restricted list; (d) curtailment of overnight liberty on foreign stations; (e) regulation of prostitution and exposure by medical inspection and effective shore patrols with cooperation of local authorities, where practicable; (f) enforcement of the provisions of General Order 69A, with particular reference to reporting exposure and supervised prophylaxis; (g) courts martial.

The recommendation of the force surgeon, scouting force, that pay checkage be abolished in case proper prophylaxis is taken, in the belief that prompt treatment after exposure will be encouraged, is of interest in this connection (1).

(3) Medical methods: These are closely correlated with the preceding and include: (a) Proper observance of general orders and circular letters issued relative to general preventive routine; (b) periodic surprise venereal inspection; (c) establishment of effective prophylaxis.

If, as Clark states (5A) chemical and mechanical prophylaxis can not be successfully carried out in civil life, the converse is true in a military organization where, due to definitive control, it constitutes a major factor in venereal-disease prevention.

It is a remarkable fact that death rates among industrial policyholders of the Metropolitan Life Insurance Co. showed the largest yearly drop ever recorded in 1918, due very largely to venereal-disease control measures employed after our entry into the World War (5A).

It is undoubtedly true that present prophylactic results, particularly on the Asiatic and other foreign stations, with high exposure hazards, can be progressively bettered by constant and repeated emphasis on the technique and the importance of early prophylaxis—if possible, use before as well as immediately after exposure.

The regimental surgeon, Sixth Regiment United States Marines at Tientsin, China, properly cites accessible, inexpensive prostitution, indulgence in alcoholic beverages, combined with youth of the men, and carelessness by them in the administration of medical prophylaxis as the important factors in high incidence (1).

The fleet surgeon, Asiatic Fleet, summarized the situation nicely in placing the blame for the seriousness of the venereal problem on the Asiatic Station on cheap prostitution and cheap intoxicating liquor, little opportunity to associate with respectable girls, lack of self-control by some individuals, and unintelligent, careless use of sanibutes (2).

What of the all-important matter of active individual treatment in its relation to prevention and control?

It is true that as far as the naval service as a whole is concerned the broad general policies in regard to routine treatment are laid down in periodically issued general orders and circular letters, as recently evidenced in the important matter of active antisymphilitic therapy. Such regulation makes for a well-integrated general therapeutic policy throughout the service, but at the same time it very wisely and very fortunately leaves the working out of the essential details of active treatment as applied to the individual case to the medical officer. There is no more potent source of harm in military medicine than the easy tendency to yield to the fascination of a routine—to become slave of a system of treatment without reference to the special needs and tolerances of the individual patient. This evil is most apparent in the active treatment of venereal disease.

If, as competent authorities hold (5A) (11), we must rely principally upon medical measures, i. e., active treatment methods to render individuals noninfectious—and the problem of infectious spread is of prime importance, because of inevitable frequent contacts between naval personnel and the civilian population—it is essential to select carefully, and prove by actual clinical trial, the best available modern treatment methods.

#### SUMMARY

1. Military efficiency is directly proportional to effective venereal-disease control.

2. Total venereal-disease admissions, United States Navy (1929), were 14,968—a total of 204,110 sick days, an incidence rate per 1,000 of 127.51—a noneffective rate of 4.76.

3. The total venereal-disease hospital admission rate, British Navy (1929), was 73.74 per 1,000—a disability loss of 130,041 sick days.

4. The total venereal-disease admission rate for the United States Asiatic Fleet (1929) was 454.57 per 1,000—3.56 times the rate of the Navy as a whole, and constituted 22.2 per cent of total admissions in the Navy.

5. The fluctuating noneffective rate of the service as a whole is related directly to increasing infections contracted on foreign stations.

6. A statistical study of venereal disease in the South China patrol, Asiatic Fleet (miscellaneous vessels), and whole Navy is presented showing comparative numerical incidences and comparative incidence rates.

7. In 1930 in the South China patrol, admissions for gonorrhea (numerical) decreased 37.66 per cent; syphilis admissions increased 15 per cent; chancroid admissions decreased 14.29 per cent as compared with 1929. Total venereal-disease admissions (numerical) in 1930 decreased 22.22 per cent compared with 1929. At the same time, the total numerical venereal admissions for the Asiatic Fleet (miscellaneous vessels) and the whole Navy increased 7.4 and 5.08 per cent, respectively, compared with 1929.

8. The increased incidence of syphilis in 1930 was due to delayed, careless use of prophylaxis by first-cruise men.

9. The trend of civilian medicine is toward centralization—civilian methods of venereal-disease control mirror this tendency.

10. The estimated prevalence of syphilis in the United State is 643,000; of gonorrhea, 474,000.

11. The estimated incidence of syphilis in the United States is 423,000; of gonorrhea, 679,000. The estimated attack rate for syphilis is 3.46 per 1,000; for gonorrhea, 5.71 per 1,000 as a minimum.

12. It is probable that syphilis is on the increase and that gonorrhea is not decreasing.

13. A total of 21,000,000 working days (male) are lost annually through venereal disease—6 per cent of the total annual loss in working time due to all diseases.

14. Direct statistical comparison between civilian and military rates is not possible.

15. The principal civilian methods of control are educational, law enforcement, and medical.

16. Mechanical and chemical prophylaxis can not be successfully carried out in civil life.

17. Military methods of control include educational and morale, disciplinary and regulational, and medical. The establishment of effective prophylaxis is possible and essential in a military organization.

18. Properly prosecuted active treatment methods offer the best means to control infectious spread.

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#### HEALTH CONDITIONS IN GUAM

##### REPORT OF THE DEPARTMENT OF HEALTH FOR THE FISCAL YEAR 1931<sup>1</sup>

By F. E. PORTER, Captain, Medical Corps, United States Navy

The department of health of the island of Guam embraces the entire medical personnel of the hospital and of the station, although nominally it includes the health officer, the assistant health officers, the sanitary inspector, the Hospital Corps men at the six dressing stations outside of Agana, and the Red Cross nurses and the graduate native nurses in the outlying districts.

The work of Susana Hospital dovetails with that of the naval hospital and the total medical activities of the naval hospital chiefly

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<sup>1</sup> Exclusive of service personnel.



concern the welfare and treatment of the island population. There are usually 9 medical officers, 9 Navy nurses, 1 dental officer, 2 chief pharmacists, 45 Hospital Corps men, and 21 native nurses on duty on the island. All of these are employed in a dual capacity as all do work directly or indirectly for service personnel and for the natives.

During the fiscal year 1931, there were 2,246 admissions and readmissions of natives to the hospital. There were 31,025 dressings and redressings with other treatments at sick call of cases not admitted to the sick list. Out-patient dressings and treatments at the hospital are done in both the officer of the day's dressing room and the native clinic. The school teachers cooperate in sending to the hospital (if within reasonable distance) all children with any sort of open lesion. If in outlying districts, the Hospital Corps men supply the needed dressing or treatment or transfers to the hospital as indicated.

Emergency dental treatment of civilian patients in the hospital is done when possible by the dental officer attached to the naval hospital.

During the greater part of the year eight men patients and six women patients have been at the hospital for tubercular patients. At the end of the fiscal year there were 11 patients, men and women. There were 11 deaths at the hospital for tubercular patients during the year and five were discharged to their homes.

One female leper patient with active lesions was transferred to Culion Leper Colony, P. I., on June 24, 1931. There are now 10 lepers from the island in Culion Leper Colony, and 4 inactive cases on the island under supervision. There are five insane patients in Philippine institutions for the insane.

At the native clinics throughout the island, the number of dressings, redressings, and treatments were as follows: Agana (31,025); Inarajan (12,612); Merizo (9,972); Piti (5,364); Sumay (11,376); Agat (10,800); Yona (5,450); Dededo (4,476); a total of 91,075. Fourteen thousand, six hundred dressings and treatments were administered at the eye, ear, nose, and throat clinic during the year. Ascariasis in children under the school age continues to be a large factor in the mortality table. Children in this class are frequently brought to the hospital when their condition is such that medical aid is too late. Effort is being made by the health department and school-teachers to educate the parents to apply for aid as soon as a child becomes ill. Hookworm infection has appeared to be increasing and special efforts are being made to locate and treat all cases and a campaign of education is being carried on both through the Hospital Corps men located at the various dressing stations throughout the island and by lectures to the school-teachers in the native schools.

Yaws continues to be quite prevalent but is easily controlled by appropriate treatment most of which is given at the naval hospital. Known gangosa cases are kept under observation and treatment given when indicated. There have been seven new cases treated during the year.

A total of 2,234 doses of arsenicals were given to civilians on the island during the year 1931. Worm treatments were given as follows: Agana, 2,832; Yona, 560; Merizo, 725; Sumay, 625; Inarajan, 519; Agat, 575; Dededo, 491; Piti, 529; a total of 6,856. At the end of the fiscal year there were 300 cases of yaws and 298 cases of gangosa under observation. There were 45 complete courses of typhoid vaccine administered to school children during the year and 40 complete courses given to members of the Guam Militia.

All schools of the island are visited on an average of twice yearly by the assistant health officer and all who volunteer are given worm treatment. Usually all children in the schools volunteer for this treatment. In addition, a yearly physical examination of all school children is made. Those found in need of medical treatment of any sort are sent to the naval hospital in Agana, where appropriate treatment is undertaken.

The following is a list of communicable diseases diagnosed and treated in this hospital during the year:

Abscess, all forms.....	40	Chicken pox.....	2
Angina, Vincent's.....	2	Gangosa.....	1
Bronchitis, acute.....	45	Influenza.....	4
Catarrhal fever, acute.....	230	Pneumonia, broncho.....	19
Carbuncle.....	6	Pneumonia, lobar.....	7
Cellulitis.....	82	Tetanus.....	1
Diphtheria.....	10	Tonsillitis.....	97
Dysentery, entamebic.....	2	Typhoid fever.....	2
Dysentery, unclassified.....	33	Yaws.....	68

The native nurses, trained at the naval hospital and the Susana Hospital in Agana, fulfill a very important mission, especially among women and children throughout the island, but considerable territory yet remains not provided for. Sixty-five native nurses have been graduated at the training school. At the present there are 10 native nurses under training; none were graduated during the year 1930. An improvement in the nurse work of the island initiated the past fiscal year was the assignment of willing graduate nurses to postgraduate courses at the training school, thereby greatly improving their qualifications. Upon graduation native nurses are retained in the hospital until they resign or are discharged for cause.

One Hospital Corps man is assigned to each of the following outlying districts: Piti, Agat, Merizo, Inarajan, Yona, and Dededo. These trained corpsmen are selected on account of their qualifica-

tions and have done excellent work. There are 40 Hospital Corps men in Agana and 2 at Sumay, the two larger centers of activity; 1 at the hospital for tubercular patients and 1 assigned to the assistant health officer.

The topography of the naval hospital reservation remains practically unchanged since last report except that filling in swampy land of the southeastern section of reservation has been continued when materials for such purpose have been available. In time it is believed this area should be entirely filled and possibly the hospital for tubercular patients now located on the bluff to the south of Agana moved to this location. Extensive repairs to these structures will be required in the near future. Due to the isolated location and the peculiar temperamental characteristics of the native population, the great number of tuberculosis patients on the island who would be benefited by this institution do not avail themselves of its facilities.

The location on the hospital reservation suggested above, while not as satisfactory as the present location from a hygienic standpoint, it is believed will induce a greater number who would be benefited by hospital treatment to avail themselves of the benefits of such hospitalization.

The buildings are constantly being repaired due to climatic conditions.

The general sanitation of the island leaves much to be desired, but the very limited supply of funds available does not permit any great progress from year to year. The water supply continues to show *B. coli* contamination from time to time. Just why Asan and Agat water should show such contamination we have been unable to determine, as the sources of supply to both these systems are springs coming from high hills or cliffs and emptying directly into concrete reservoirs from which it is conducted in pipes to the various activities.

Ditches are provided above these springs and reservoirs to conduct the surface water away. There have been no water-borne diseases of consequence either among the whites or the native population. The latter, as would be expected, are not particularly careful of their drinking water. It is possible that chlorination of the water supply would be desirable and recommendation to this end is being considered. If funds can be made available it is believed a wider distribution of the Asan spring water in Agana should be made in order that the use of the "Fonte" river water by the native population, except for bathing and laundry purposes may be eliminated.

The new water tank at marine barracks, Sumay, has proved of great benefit to the government quarters and civilian population of Sumay.

The disposal of sewage and fecal matter in Agana is inadequate and it is believed that increased sewage facilities should be provided in order that many of the natives may provide themselves with flushing toilets and the unsatisfactory can disposal of "night soil" may be reduced to a minimum. In certain districts away from the beach it is believed public toilets and baths would be a most desirable improvement from a sanitary standpoint and the incidence of round-worm infestation greatly reduced. Both the native population and the white children on the island show a high percentage of round-worm infestation.

A survey by the assistant health officer would indicate the following disposal of "night soil" in Agana. Into the sea inside the reef 70 per cent, by burying under or near homes, emptying into Agana River, and burying in outskirts of town 30 per cent.

The remedy indicated is adequate sewers with public and private flushing toilets or surface toilets with approved sanitary cans which may be collected by a "night soil" squad and disposed of under supervision of the health department.

The Agana River is a constant problem from the standpoint of sanitation, due to the practice of many of the natives throwing prohibited garbage, "night soil," and refuse into it. Although constant efforts to prevent such practices are made, the one sanitary inspector can not, of course, prevent some contamination from these sources.

The disposal of garbage and food residue is unsatisfactory. The methods now used are the beaches, the Agana River, and other streams and the public dump which is adjacent to a thickly settled area. However, at the present time most of this residue is used as a fill at the ball park and as long as it is covered promptly with earth has given no serious trouble. To correct this there should be an incinerator and adequate garbage receptacles which can be sterilized in some manner, or preferably a means of collection and transporting this residue and dumping at sea outside the reef.

The venders of food and drink present a constant problem and most of these places at least are far from satisfactory. From a sanitary standpoint some improvement during the past year has been made.

Quarantine measures are enforced when necessary to prevent the introduction and spread of communicable diseases from visiting vessels and personnel arriving here for duty. During the past year no ships were quarantined.

One hundred and ten civilians died in this hospital during the past year. The causes were as follows:

Abscess, brain.....	4	Injuries.....	1
Ascariasis.....	4	Malnutrition.....	2
Asthma.....	6	Myocarditis.....	5
Appendicitis.....	1	Nephritis.....	2
Burn.....	1	Obstruction, intestinal.....	2
Bronchitis.....	1	Pneumonia, all forms.....	17
Cancer.....	4	Pregnancy.....	2
Diarrhea.....	3	Pyemia.....	1
Dysentery.....	12	Still born.....	11
Diphtheria.....	2	Shock, surgical.....	1
Gastric hemorrhage.....	1	Tuberculosis.....	18
Gastroenteritis.....	9	Tetanus.....	3
Hemiplegia.....	1	Whooping cough.....	1

The following operations were performed in this hospital upon civilian patients.

*Major operations*

Amputation, leg.....	2	Thyroidectomy.....	2
Appendectomy.....	37	Oophorectomy.....	10
Bunionectomy.....	1	Open reduction, fracture of radius.....	5
Cesarean section.....	3	Open reduction, fracture of clavicle.....	3
Cholecystectomy.....	1	Perineorrhaphy.....	2
Exploratory laparotomy.....	4	Removal of stone in bladder.....	1
Herniotomy.....	10	Salpingectomy.....	12
Hysterectomy.....	15	Suspension of uterus.....	3
Laminectomy.....	1		

*Minor operations*

Amputation, finger.....	1	Excision, foreign body.....	4
Circumcision.....	14	Excision, rectal fistula.....	2
Curettement of bone.....	2	Extraction of teeth.....	4
Cystoscopic examination.....	5	Hydrocele.....	2
Dilation and curettage.....	9	Hemorrhoids.....	6
Excision, cyst.....	8	Incision of abscess.....	6
Excision, glands.....	2	Repair, incision.....	1
Excision of tumor.....	3	Repair, lacerated tendon.....	1
Excision of lipoma.....	1	Transfusion, blood.....	4

*Eye, ear, nose, and throat operations*

Adenoidectomy.....	13	Tonsillectomy.....	99
Iridectomy.....	1	Transplantation of pterygium.....	1
Mastoidectomy.....	2	Removal, foreign body, ear.....	1
Glaucoma.....	1	Lacrimal abscess.....	2

One thousand and twenty cases were admitted to ward 3 (women and children) during the past year and 750 cases were admitted to ward 1 (male) during the past year. Four hundred and seventy-six cases were admitted to Susana Hospital during the year.

The following laboratory examinations were recorded:

*Blood*

Red cell counts.....	310	Malaria.....	22
White cell counts.....	478	Typing.....	4
Differential counts.....	459	Widals.....	20
Hæmoglobin estimations.....	310	Sugar.....	58
Coagulation time.....	128	Urea Nitrogen.....	8
Stippling.....	6	Creatinine.....	8
Cultures.....	26	Icterus index.....	10
Occult.....	30	Kidney function.....	13
Kahns.....	1,909	Nonprotein nitrogen.....	8
van den Bergh.....	8		

*Feces*

Ova and parasites.....	3,060	Occult blood.....	40
Amœba.....	78	Bile.....	4
Culture for B. dysentery.....	2	Concentration for ova.....	2

*Urine*

Routine and micro.....	2,105	Occult blood.....	68
Sugar quantitative.....	21	Bile.....	11
Acetone.....	120	Albumin quant.....	16
Diacetic acid.....	128		

*Cultures*

Pleural fluid.....	8	Blood.....	7
Throat.....	24	Miscellaneous.....	150

*Dark fields—18*

*Spinal fluids*

Globulin.....	27	Stain for A. F. B.....	9
Cell count.....	27	Gram's stain.....	15
Differential.....	6	Kahn.....	6

*Smears*

Tuberculosis.....	978	Gonorrhea.....	400
Vincent's Angina.....	66	Miscellaneous.....	300
Leprosy.....	60		

*Miscellaneous*

Soap analysis.....	52	Autopsies.....	200
Triple typhoid.....	23	Water analysis.....	176
Cowpox vaccination.....	385	Liquors.....	26
Cholera prophylaxis.....	382	Chemical analysis.....	4

Total, 13,823

Frequent examinations of water supply of the island have been made. Presumptive tests for *B. coli* were positive in the water supply at frequent intervals. Frequent inspections of the sources of water supply for the island are made by the health officer, the assistant health officer, and the Hospital Corps men of the different districts.

Twenty-five thousand nine hundred and fifty-one leper and special rations were issued during the year, an average of about 71 rations daily.

The naval dental officer performed 191 treatments during the fiscal year for civilians. One thousand three hundred and fifty-five school children were given dental examinations during the year by the civilian dentist and 4,012 operations and treatments were done for the school children during that period.

Two hundred and nine autopsies were performed in the hospital during the fiscal year.

The following is a report of the leper and special fund under supervision of the health officer:

*Leper and special appropriation*

	Spent to date		Spent to date
Dental material-----	\$52. 17	Provisions-----	6, 415. 23
Salary of dentist-----	1, 430. 00	Stubs and requisitions-----	2, 321. 27
Care of lepers-----	1, 422. 09		
Gratuity of lepers-----	540. 00	Total-----	21, 253. 50
Care of insane-----	1, 125. 00	Unobligated balance-----	117. 93
Civilian pay roll-----	7, 947. 74		

**IN SUPPORT OF ADDITIONAL PROTECTION AGAINST VENEREAL DISEASE**

By A. C. GELATTE, Chief Pharmacist's Mate, United States Navy

After years of strenuous effort to reduce the venereal-disease incidence to a point below that which constitutes a serious health hazard, gonorrhea, syphilis, and chancroidal infections have continued to be and still remain among the leading causes of sickness and of disability in the Navy. The annual reports of the Surgeon General show that year after year more effort is made to reduce the incidence of the venereal diseases, but the results, as shown by statistical figures, are not as encouraging as might be expected from the reported efforts toward control. Of course, without the use of the preventive measures that have been and are now being employed, the venereal-disease rates in the Navy would undoubtedly be much higher, but the experience of the American troops in China (6) indicates that added protection, as used so successfully by them, would go far toward reducing the venereal-disease rate to a minimum in the Navy.

With the subject so completely covered in previous articles it will not be necessary here to describe at length the various phases of the venereal-disease situation in the Navy, but for the purpose of pointing out the necessity for, and the possibilities of, certain added protection against venereal-disease infection, the results of a statistical study of 20 years' experience is of immediate interest.<sup>1</sup>

In 1908 the system was begun in which every case of venereal disease is reported as an admission, whether the infected individual is excused from duty or not—cases in which no sick days are involved are admitted “for record only” and the case is recorded as a regular admission. By the year 1909 this system was in full operation and has continued so to date. Therefore, omitting the World War period (1917–18) comparable figures are available for the 20 years included in the 22-year period 1909–1930. Conditions during the war were so different from peace time conditions that in comparing venereal disease rates the two years covering the war period must be omitted. The weighted average admission rates per 1,000 for the 20 years included in the periods 1909–16 and 1919–1930 and the weighted average rates per 1,000 for the 8-year pre-war period 1909–1916 and the 8-year postwar period 1919–1926 are given below. The period 1923–1930, or the last 8-year period of the 20 years, is also shown for comparison.

TABLE 1

Time periods	Weighted average rates per 1,000			
	Gonorrhea	Syphilis	Chancroid	Gonorrhea, syphilis, chancroid combined
20 years, 1909–1930, less war period (1917–18).....	78.74	20.63	33.66	133.03
8-year prewar period, 1909–1916.....	89.78	22.89	49.08	161.76
8-year postwar period, 1919–1926.....	76.25	18.52	27.25	122.02
8-year period, 1923–1930.....	75.70	21.74	30.63	128.05

From the 20-year weighted average it at first appears that 13.3 per cent of the personnel is admitted each year with a new case of gonorrhea, syphilis, or chancroidal infection, but the weighted average for the 8-year period before the war, the 8-year period after the war, and the last 8-year period for the 20 years show this percentage is not constant. The weighted average for the 8-year period before the war indicates that the admissions annually for that period were 16.17 per cent of the personnel as compared with 12.2 per cent for the 8 years following the war and 12.8 per cent for the last 8 of

<sup>1</sup> The subject of venereal diseases in the Navy, i. e., the conditions that exist, preventive measures used, etc., has been well covered in previously published material. A few of these articles, covering the vital points of the subject, are mentioned here as a guide should the reader desire a detailed account of Navy venereal-disease experience. See references (1), (2), (3), and (4) in the bibliography.



the 20 years. It appears that the lessons learned during the war had a decided effect, and that the continued rigid application of the various items that go to make up the preventive campaign is responsible for the reduction in the percentage of admissions from 16.17 per cent to 12.2 or 12.8 per cent. Though these figures show a decided reduction in the percentage of personnel admitted annually since the war, it can not but be admitted that even 12 per cent constitutes quite a damage to the service and that this figure should be further reduced if possible.

For the purpose of determining the rate at which the incidence of venereal disease is increasing or decreasing, the figures for any one year are not altogether comparable with the figures for the preceding or following year, because of the variation of admission rates due to different conditions of the naval organization, ports visited by ships during the year, liberty conditions in various ports, especially during fleet-concentration periods, etc. To make satisfactory comparisons the weighted average rates for a 5-year period will probably give the nearest possible true picture. Because the pre-war period is made up of 8 years, the two pre-war 5-year periods will necessarily overlap, so that in order to show like periods for comparison the post-war 5-year periods are overlapped in the same manner. The weighted average rates for the last two 5-year periods, 1921-1925 and 1926-1930 are shown separately for further comparison. The weighted average rates for the above 5-year periods with the rates for 1929 and 1930 separately are as follows:

TABLE 2

Time periods	Weighted average rates per 1,000			
	Gonorrhea	Syphilis	Chancroid	Gonorrhea, syphilis, chancroid combined
Pre-war 5-year periods:				
1909-1913.....	92.88	24.04	49.67	166.59
1912-1916.....	84.67	21.66	48.73	155.07
Post-war 5-year periods:				
1919-1923.....	75.32	17.72	26.54	119.59
1922-1926.....	79.13	19.99	27.70	126.82
1925-1929.....	73.64	22.10	30.14	125.88
Last two 5-year periods:				
1921-1925.....	80.35	19.11	27.21	126.67
1926-1930.....	72.59	23.19	31.55	127.34
1929.....	74.76	21.64	31.11	127.51
1930.....	73.72	25.03	35.02	133.77

The 1930 admission rate for combined gonorrhea, syphilis, and chancroidal infections compared with the admission rate for the preceding year shows an increase of 4.91 per cent, but when the admissions for 1930 are included in the 5-year period 1926-1930 and this period compared with the preceding 5-year period 1921-1925 the rate for the years 1926-1930 is only 0.53 per cent greater.

The increase in the rate for 1930 over that for 1929 would, therefore, seem to be nothing more than a slight increase over the expected annual fluctuations, the increase being chargeable to syphilis and in a greater degree to chancroidal infections.

The figures in Table 2 for periods since the war indicate that gonorrhea has been kept at the low mark and in fact has been slightly reduced, but they show a gradual increase in the rates for syphilis and chancroidal infections. This can probably be seen more clearly by showing the range of the annual rates for two postwar periods. Excluding the year 1919 in which all rates were low due to postwar influences, the annual admission rates per 1,000 ranged, for the six years 1920-1925 and for the five years 1926-1930, as follows:

TABLE 3

Time periods	Gonorrhea	Syphilis	Chancroid
<b>6 years 1920-1925:</b>			
High.....	84.94	20.04	32.88
Low.....	78.06	17.54	24.14
Weighted average for period.....	80.12	18.82	27.63
<b>5 years 1926-1930:</b>			
High.....	74.76	25.03	36.36
Low.....	71.06	21.64	25.73
Weighted average for period.....	72.59	23.19	31.55

The increase in the syphilis rate is very probably due to the increasing improvement in diagnostic facilities and increased interest in this disease, resulting in the detection in recent years of a greater proportion of syphilis cases. This is apparent from the gradual narrowing of the ratio of syphilis admissions to admissions for chancroidal infections as shown in Table 4. These ratios seem to indicate that cases which might have been recorded as chancroidal infections in previous years have been properly diagnosed as syphilis in recent years, resulting in a "transfer" from chancroid admissions to syphilis admissions. In this connection it is significant that Kahn unit outfits were made available to all ships and stations December 30, 1925, by Bureau of Medicine and Surgery circular letter serial No. 420-1925.

TABLE 4

Time periods	Ratio of syphilis to chancroid
<b>Prewar periods:</b>	
1909-1913.....	1-2.065
1912-1916.....	1-2.349
<b>Postwar periods:</b>	
1919-1923.....	1-1.497
1922-1926.....	1-1.385
1925-1929.....	1-1.363
<b>Last two 5-year periods:</b>	
1921-1925.....	1-1.424
1926-1930.....	1-1.360

From Tables 2 and 3 it is clear that, while the chancroid rate is still below the pre-war rates, chancroidal infections have been increasing gradually since the war. This is probably due to the fact that complete prophylactic treatment, which includes the soap and water wash, must usually be delayed until the man returns to the ship. This, of course, is in many cases too late to be effective. Complete and early prophylaxis is necessary with the methods now in use to reduce the chances of contracting venereal disease after exposure and the taking of complete prophylaxis early enough appears to be the difficulty. It is well known that the use of the "sanitube" can not be considered as complete prophylaxis. However, to cover this point the following is quoted from "The Management of Syphilis in General Practice" (5):

Remember that soap and water is protection against chancroid and partially against syphilis, protargol against gonorrhea, and calomel ointment probably only against syphilis.

Before and since the war an extensive search has been made for one drug or a combination which might prove effective against all three diseases, but so far without satisfactory results.

If prophylactic treatment under the direction of a physician is not available, it is worth while for the patient to be advised to use one of the individual prophylactic packets put out by various commercial houses, directions for the use of which usually accompany the packet. Though this is not as satisfactory as the scheme outlined above, the experience of the United States Navy and the Australian and New Zealand troops during the war indicated that it was of some value; and the prevention of only a single case of syphilis is a worthwhile accomplishment.

In 1930 the annual rate per 1,000 of total personnel for combined venereal diseases was 133.91.<sup>2</sup> This is the highest since 1924, when the rate was 137.91. The Surgeon General's report for 1931 charges the probable cause for the 1930 increase to the visit of the fleet to the various ports in the West Indies during the fleet concentration period. The report also states: "Most ships reported that the crew had been thoroughly warned of the danger of venereal diseases and their prevalence in these ports and that all the usual preventive measures were placed at their disposal both ashore and on board ship."

Medical prophylactic measures when taken early enough after exposure and when properly applied have been conclusively demonstrated to be effective in reducing the incidence of venereal diseases in our own and in foreign military and naval services. Having the material and the knowledge of the manner of use, the problem, as brought out previously, becomes one of finding a way to induce the persons who expose themselves to take proper precautions immedi-

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<sup>2</sup> Includes 16 admissions for verruca acuminata, venereal, not considered in previous figures.

ately or as soon after exposure as possible. For the benefit of those who will, after all, expose themselves, instruction is given in the proper application of the prophylactic tube to be used "on the spot" and the other prophylactic measures to be used upon return to the ship or sooner if available. Further warnings that early and complete prophylaxis is necessary to prevent infection are given in General Order 69 (amended) and the loss of pay for sick days, etc., are also explained.

As shown by statistical figures, this procedure has been successful to a degree, and coupled with the strenuous efforts put forth by the officers concerned, has kept the incidence of venereal disease down to the extent that the rate for combined venereal diseases in any year since the World War is lower than for any year in the pre-war period, 1909-1916. The educational campaign, encouragement of athletics, etc., are probably more effective than the figures tend to show, for "the undiscernible few or many who are influenced" can not be detected by available statistical figures. Nevertheless, when it is considered that the daily average noneffective rate (sick days) for the 5-year period 1925-1929 was 460 per 100,000, which represents a damage to the service to the extent that 532 persons, out of an average strength of 115,580 for the period, were daily on the sick list with a venereal disease, it is evident that the rate remains high enough to indicate that the incidence of venereal disease still constitutes a definite health hazard for which additional protection should be instituted if possible.

Obviously, in the case of a certain percentage of the personnel the predominant influence of sex urge can not be combated successfully with the methods now in use. The rate at which men do and will continue to expose themselves to infection is a matter of great importance to the health and efficiency of the Navy. There are some who will not expose themselves, but in spite of anything practicable that can be done there can be no hope for total abstinence. It appears from past experience that many men are indifferent to the consequences of exposure to illicit sexual intercourse and will not seek immediate medical prophylaxis, even though they know early treatment to be effective. Such men are usually under the influence of intoxicating liquor when exposed and this is very likely the "group" responsible for the continued high venereal rates. In this connection it is interesting to note that the admissions to the sick list for venereal disease in Nicaragua were considerably reduced by requiring all men to take prophylaxis, under supervision, who returned from liberty under the influence of intoxicants.

In two ports in China (Chefoo and Tsingtao) prophylaxis stations are maintained ashore with Hospital Corps men always on duty and patrols are established around the red-light districts. All

men visiting these districts are required to take prophylaxis, presumably whether they claim to have been exposed or not. This seems to have reduced the incidence of venereal disease in these two ports to a gratifying degree. If it were possible to control liberty parties ashore in this manner in all ports visited by ships a large portion of the problem would very probably be solved, but this procedure is not often practicable, because of the fact that many ports do not have districts easy to patrol, for many prostitutes not in segregated districts ply their trade at random.

The experience of the American troops in China, referred to at the beginning of this article, is quoted below as published in the *Military Surgeon* of September, 1931, under the title of "A Splendid Job of Prevention and Control" (6):

The venereal rate of American troops in China reached a high mark for all time during the latter part of last year. For the month of October it was 566 per M per annum. About this time the commanding officer and his medical staff got together and started an intensive campaign, with results as shown in extracts from Sanitary Reports for April, and surgeon's letter, May, 1931:

"During the month of April, 1931, one case of gonorrhea occurred in the command. This case quite evidently was one of long duration which had suffered an acute exacerbation. It was the first one which had occurred in the command since January, 1931, and is not properly chargeable.

"The intensive campaign against venereal disease has continued. The use of the prophylaxis at the station hospital is in force, but the soldier is also provided with a prophylactic packet to be used 'on the spot,' so that the element of elapsed time is eliminated. Soldiers are also ordered to use the condom.

"Squad leaders in all organizations are required to make a venereal inspection of squad members once in every 48 hours and to report to a medical officer any abnormality, including the most insignificant appearing scratch or abrasion. Such scratches or abrasions are treated with mercurochrome solution and the man restricted to the compound, receiving daily observation until the trauma has disappeared. Usually a few days' restriction suffices.

"The excellent results obtained for a period of more than three months can not be attributed to any one factor, but the surgeon is of the opinion that primarily it is an administrative triumph and that the commanding officer by his forceful insistence upon the regulations being observed, is responsible.

"The 48-hour inspection of all men by squad leaders with early detection and treatment of aforementioned scratches and abrasions may account for the decrease in chancroid infections, but only the use of the condom and the prophylaxis can account for the clean record for gonorrhea and syphilis.

"Your letter dated April 23d at Bagulo arrived this morning. I am glad you say you want me to write from time to time for I am desirous of doing so. I know of no report that can be quite so informative as a personal letter.

"The venereal situation remains surprisingly good—excellent. I do not propose to explain reasons for the marvelous results, but in my opinion it is due to the fact that the men are actually using the condom and prophylactic treatment. They are afraid not to. Our lay brothers appear to think that there is something new under the sun. I think they are right. *The regulations are being enforced!* Raycroft deserves much credit in this reduction of the venereal rate, for the men have confidence in him and undoubtedly

waste no time in coming to him earlier than has ever been the case in my experience. Whether small abrasions treated at once is a preventive for chancroids I do not know, but the men think it is and it is not a bad thing to have them think so. The fact is that no such treatment will prevent gonorrhea or syphilis and these diseases are also down to the negligible point. My opinion will continue to give much credit to enforcement of the orders. Colonel Taylor gives Raycroft credit for having sold the idea to him that the terrible situation could be very much improved. We are strong for giving the commanding officer the credit and responsibility."

The above is self-explanatory and no comment is attempted here except to note that the result obtained from the organized efforts, i. e., reducing the venereal-disease rate from 566 per 1,000 to "none" for a period of three months, is no less than remarkable and even more so because of the Asiatic locale. A point of primary interest, however, is the advantage of the condom to the present system of prophylaxis. It is apparent that its enforced use aided in no small way the success of this excellent performance.

The use of the condom has been recommended by several Navy medical officers from time to time as an added means of protection against infection. The substance of these recommendations is that a condom be added to the present sanitube packet and each individual answering "no" upon return from liberty be required to return the packet; those answering "yes" be required to take complete prophylaxis under supervision on board ship. It is quite probable that many men at the time of exposure are under the influence of intoxicating liquor and do not properly apply the contents of the present prophylactic packet or seek early and complete prophylaxis. If a condom is readily available it is almost certain to be used by the sober man when exposed and if a man is under the influence of intoxicating liquor he will be more apt to use it than he will to seek early prophylaxis or even to apply the "sanitube" properly.

After a study of the results of 20 years' experience in venereal-disease prevention in the Navy there leaves no doubt that additional protection is necessary to reduce the incidence of venereal disease, and the damage to the service caused thereby, to a minimum. The very successful experience cited above (6) proves the effectiveness of the condom as an added protection against all the venereal diseases and the addition of the condom to the present Navy prophylactic packet should be given early consideration.

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#### ANNUAL PHYSICAL EXAMINATIONS AND VITAL STATISTICS

By ETHEL M. NALLS, Section of Vital Statistics, Bureau of Medicine and Surgery, Navy Department

The importance of vital statistics to the practice of preventive medicine can not be overstated. Without the statistical method comparatively little progress would have been made in epidemiology and less toward the prevention and control of disease.

As a result of the thorough survey of the physical records of all officers of the United States Navy and Marine Corps for a 5-year period it was observed that many defects were susceptible of correction in their earlier stages. Each year an increasing number of correctable defects are listed in the reports as having received appropriate surgical or medical treatment, which in the majority of instances results either in a permanent cure or in arresting the progress of incipient disease. Detailed analyses of these records are being made each year and the results summarized and tabulated in order that this large amount of data might be utilized for purposes of study in further improving health and promoting longevity.

One of the most frequent deviations from normal is weight. Insurance companies have of necessity stressed the importance of weight in its relation to height and age as a determining factor in longevity, because the initial physical examination and subsequent death of the insured constitute the only information available for statistical study. With the officer personnel of the Navy and Marine Corps the situation is quite different. Each year they receive a thorough examination, have remediable defects corrected, and are more or less constantly under the surveillance of medical officers, receiving advice regarding their routine of personal hygiene or health habits, nutrition, sleep, exercise, recreation, etc., which should have considerable bearing on subsequent health and longevity. Constant effort is being made to keep the officer personnel in a high state of mental and physical efficiency, and the principles of preventive medicine are being applied for this purpose.

The idea of comparison is always involved in statistics, but to make satisfactory comparisons we should have available standard

rates or so-called "norms." Standards of human body weight are of vital interest. Experience in analysis of the annual physical reports indicates that the average stated in the Metropolitan or Symonds' tables for civilian male risks do not accurately fit the officers of the Navy and Marine Corps. Medical officers compelled to recommend corrective procedures according to these averages do so against their own judgment.

These officers as a class are picked specimens and careful consideration must be given to the type of frame and musculature in formulating any statement of averages or in adjudging over-weight. A study should be made of these records over a period of years to establish a definite standard of averages applicable to Navy and marine officers. Although weight is one of the most frequent deviations from normal, it should be properly evaluated as only one of the many indices of physical and mental efficiency.

Correct vital statistics depend upon the accuracy and completeness of the basic data. Reports are incomplete when any of the data required on the form is omitted. The benefits derived from the annual physical examination depend on, not only the cooperation of the officer being examined, but also on the medical examiner. Some medical officers are inclined to be rather inflexible in their recommendations for correction of minor defects, particularly slight deviations, while others ignore conditions which should be noted. A statistical study from such evidence is not a true picture of existing conditions.

It is impossible to make comparative statistical studies from year to year when the same conditions are reported differently or in some cases not at all. Recognizing that for health conservation attention should be paid to minor defects and early manifestations of more serious disabilities, it is requested that all deviations from normal be listed whether slight, moderate, or marked, and in the final analysis all conditions not considered worthy of note will be eliminated.

This complete reporting will not only give a wonderful opportunity for observing from year to year the relation of personal hygiene, health habits, and weight to disease tendencies, or in other words, establish direct correlation between different facts relating to sickness, but will also serve the true purpose of these statistical analyses from the standpoint of preventive medicine, that is, checking disease in its incipency.

#### HEALTH OF THE NAVY

Based on returns for diseases and injuries occurring in October, November, and December, 1931, the general admission rate, all



causes, was 565 per 1,000 per annum. The rate for the corresponding months of 1930 was 557 per 1,000 per annum and the median rate for the preceding five years, 549.

The admission rate for disease was 506 per 1,000 per annum as compared with the 5-year median for the corresponding three months, which was 478.

The admission rate for accidental injuries was 57 per 1,000 per annum. The median or expected rate for the corresponding quarter of the preceding five years was 62. Except when influenced by unusual accidents, this rate varies little from year to year.

Acute infections of the respiratory type were less prevalent than expectancy at all shore stations in the United States for this season of the year. A total of 657 cases of these diseases was reported during the quarter, 254 of which were notified in October, 243 in November, and 160 in December. The United States naval training station, San Diego, Calif., reported 72 cases of catarrhal fever in October, 57 in November, and 21 in December. That excellent health conditions existed at the United States naval training station, Hampton Roads, Va., and the United States naval training station, Great Lakes, Ill., is reflected in the low incidence of catarrhal fever, only 16 and 20 cases respectively being admitted to the sick list by these two stations.

The admission rate, all causes, for forces afloat was 524 per 1,000 per annum. The median for the fourth quarter of the preceding five years is 465.

The admission rate for diseases was slightly greater than the expected rate due to increased numbers of catarrhal fever cases which appeared in epidemic form on board several ships of the Navy during October, November, and December. The U. S. S. *Beaver* reported 49 cases; the U. S. S. *Tennessee*, 42; the U. S. S. *West Virginia*, 42; the U. S. S. *New York*, 40; the U. S. S. *Saratoga*, 40; and the U. S. S. *California*, 37. Catarrhal fever continued to be epidemic during the remainder of the winter months.

The medical officer of the U. S. S. *Tulsa* reported an outbreak of scarlet fever complicated by diphtheria, occurring between November 8 and 14, 1931. There was a total of six cases, with one fatality. "Known scarlet-fever contacts were given protective-passive immunization and throat cultures were made on the entire personnel for diphtheria. Those showing suggestive findings were given the protective-passive immunization." During the period under consideration, scarlet fever was prevalent in Tientsin, China, the liberty port for the crew of this vessel.

The U. S. S. *Henderson* reported one case of typhoid fever in October and one case of scarlet fever in November.

The Fourth Brigade, United States Marines, Shanghai, China, notified a fatal case of smallpox—admitted to the sick list on December 21, 1931, and died eight days later. No record of cowpox vaccination has been reported since his first enlistment, November 25, 1927.

The United States naval hospital, Canacao, P. I., recorded one death from cerebrospinal fever in November. The patient developed this disease while in the hospital under treatment for another condition.

Four cases of rabies developed from the bite of a dog on board the U. S. S. *J. D. Edwards* on the Asiatic Station. Twelve men were bitten within a period of about eight hours. All were bitten on the hand. Three received first-aid treatment and nine did not. Antirabic treatment was without effect, probably as it was given about 30 days after the men were bitten. The disease appeared in one to five days after antirabic treatment was started. One-third of those bitten developed rabies, which is the usual proportion for dog bites on the bare hand. The percentage of cases among those receiving first-aid treatment was the same as among those not receiving such treatment. The incubation period varied from 26 to 34 days. It is of interest to note that the first case began as a gastric disturbance. The first symptoms in all cases were nausea, vomiting, nervousness, and restlessness. Later, inability to take water was present, while soups and warm milk could still be swallowed with difficulty. One case became maniacal. Death in all cases was due to paralysis of respiration. A very high terminal leucocytosis was present. Itching and tingling at the site of the wound was present early in the disease. Death occurred 24 to 48 hours after the first symptom appeared. Negri bodies were demonstrated in all cases.

TABLE NO. 1.—*Summary of morbidity in the United States Navy and Marine Corps for the quarter ended December 31, 1931*

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	71, 316	39, 163	17, 465	110, 479
All causes:				
Number of admissions.....	9, 341	6, 212	2, 895	15, 553
Annual rate per 1,000.....	523. 92	634. 48	663. 04	564. 64
Disease only:				
Number of admissions.....	8, 422	5, 518	2, 627	13, 940
Annual rate per 1,000.....	472. 38	563. 59	601. 66	506. 09
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	1, 809	1, 685	720	3, 494
Annual rate per 1,000.....	101. 46	172. 10	164. 90	126. 85
Venereal diseases:				
Number of admissions.....	2, 921	943	670	3, 864
Annual rate per 1,000.....	163. 83	96. 32	153. 45	140. 28
Injuries:				
Number of admissions.....	908	659	267	1, 567
Annual rate per 1,000.....	50. 93	67. 31	61. 15	56. 89
Poisoning:				
Number of admissions.....	11	35	1	46
Annual rate per 1,000.....	. 62	3. 57	. 23	1. 67

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1931

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		9, 227	2, 012	81, 263	1, 177	16, 283	517	110, 479
CAUSE—DISEASE								
Primary	Secondary or contrib- utory							
Abscess, elbow.....	Septicemia.....			1				1
Abscess, periurethral.....	Septicemia.....			1				1
Adenoma.....	None.....			1				1
Alcoholism, chronic.....	None.....					1		1
Angina pectoris.....	None.....			1				1
Angina pectoris.....	Dilatation, stomach, acute.....			1				1
Appendicitis, acute.....	Peritonitis, general acute.....	1		2				3
Carbuncle.....	Septicemia.....	1						1
Cerebrospinal fever.....	None.....			1				1
Filariasis.....	Thrombosis, mesenteric.....			1				1
Heart block.....	None.....			1				1
Hemorrhage, cerebral.....	None.....					1		1
Influenza.....	Pneumonia, broncho- None.....			2				2
Nephritis, acute.....	None.....			1				1
Nephritis, chronic.....	Arterial hypertension.....			1				1
Nephritis, chronic.....	Arteriosclerosis, general.....			1				1
Obstruction, intestinal, from external causes.....	Peritonitis, general acute.....			1			1	2
Pneumonia, lobar.....	None.....			3		1		4
Rabies.....	None.....			4				4
Sarcoma.....	Metastasis, lungs, liver, kidneys, and heart.....			1				1
Scarlet fever.....	Diphtheria.....			1				1
Smallpox.....	None.....					1		1
Syphilis.....	Aneurysm, iliac arteries.....			1				1
Syphilis.....	Hemorrhage, cerebral.....			1				1
Thrombosis, coronary artery.....	Arteriosclerosis, general.....	1			1			2
Thrombosis, coronary artery.....	Myocarditis, chronic.....			1				1
Tuberculosis, chronic, pulmonary.....	None.....			1				
Ulcer, intestine.....	Peritonitis, general acute.....			1				1
Ulcer, stomach.....	Hemorrhage, stomach.....			1				1
Valvular heart disease, aortic insufficiency.....	None.....					1		1
Total for diseases.....		3		31	1	5	1	4
CAUSE—INJURIES AND POISONING								
Primary	Secondary or contributory							
Drowning.....	None.....	1		8				9
Fracture:								
Compound, skull.....	do.....			4				4
Do.....	Hemorrhage, intracran- ial.....			2				2
Simple, skull.....	None.....			1				1
Do.....	Intracranial injury.....			3				3
Do.....	Hemorrhage, intracran- ial.....			2				2
Vertebrae, cervical.....	None.....			1				1
Injuries, multiple, ex- treme.....	do.....	1		17				18
Do.....	Hemorrhage, femoral ar- tery.....	1						1
Landplane crash, injur- ies, multiple extreme.....	None.....	1						1

**TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1931—Continued**

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		9, 227	2, 012	81, 263	1, 177	16, 283	517	110, 479
CAUSE—INJURIES AND POISONING—continued								
Primary	Secondary or contrib- utory							
Intracranial injury.....	Pneumonia, broncho.....			1				1
Intraspinal injury.....	None.....			1				1
Strangulation, neck.....	do.....			1				1
Wound:								
Amputated, arm.....	Shock.....			1				1
Amputated, side of head.....	None.....				1			1
Gunshot—								
Chest.....				1		1		2
Head.....	None.....			2				2
Lacerated, face and neck.....	Edema, glottis.....			1				1
Poisoning, cyanide, acute.....	None.....			1				1
Total for injuries and poisoning.....		4		47	1	1		53
Grand total.....		7		78	2	6	1	94
Annual death rate per 1,000:								
All causes.....		3. 03		3. 84	6. 80	1. 47	7. 74	3. 40
Disease only.....		1. 30		1. 53	3. 40	1. 23	7. 74	1. 48
Drowning.....		. 43		. 39				. 33
Other injuries.....		1. 30		1. 87	3. 40	. 25		1. 56
Poisoning.....				. 05				. 04

**ADMISSIONS FOR INJURIES AND POISONING, FOURTH QUARTER, 1931**

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the fourth quarter, 1931, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, October, November, and Decem- ber, 1931	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1930
<b>INJURIES</b>			
Connected with work or drill.....	641	2, 321	2, 639
Occurring within command but not associated with work.....	480	1, 738	1, 914
Incurred on leave or liberty or while absent without leave.....	446	1, 615	1, 535
All injuries.....	1, 567	5, 674	6, 088
<b>POISONING</b>			
Industrial poisoning.....	7	25	33
Occurring within command but not connected with work.....	34	123	100
Associated with leave, liberty, or absence without leave.....	5	18	26
Poisoning, all forms.....	46	166	159
Total injuries and poisoning.....	1, 613	5, 840	6, 247

*Percentage relationships*

	Occurring within command				Occurring outside command	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or absent without leave	
	October, November, and December, 1931	Year, 1930	October, November, and December, 1931	Year, 1930	October, November, and December, 1931	Year 1930
Per cent of all injuries.....	40.9	43.4	30.6	31.4	28.5	25.2
Per cent of poisonings.....	15.2	21.0	73.9	62.9	10.9	16.1
Per cent of total admissions—Injury and poisoning titles.....	40.2	42.8	31.9	32.2	27.9	25.0

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "drug addiction" or "alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from October, November, and December, 1931, reports, are worthy of notice from the standpoint of accident prevention:

*Careless practice—Overflow of gasoline into motor boat.*—Due to negligence of other personnel while fueling, a fireman, third class, received multiple burns when gasoline overran and ignited on starting the motor. He was incapacitated 12 days from duty.

*Careless practice—Chipping paint without wearing goggles.*—A shipfitter, third class, was admitted to the sick list with a foreign body in the right eye, which occurred while chipping paint without wearing protective goggles. Loss of time, 12 days.

*Careless practice—Using emery wheel without wearing goggles.*—A marine private, while operating an emery wheel without wearing protective goggles, suffered a foreign body in the eye when a particle of metal became imbedded. The case was reported as due to his own negligence because he failed to use the protective goggles provided. Loss of time, 16 days from duty.

*Careless practice—Welding without wearing goggles.*—While a seaman, second class, was engaged in welding, without wearing the protective goggles furnished him, a fragment of steel became imbedded in the cornea, which caused his admission to the sick list for six days.

*Careless practice—Use of strong lye solution.*—Three marine privates with about  $1\frac{1}{2}$  years of service, each suffered chemical burns of the hands when they scrubbed woodwork with a strong lye solution. They were told by the corporal in charge that the lye solution "would not burn." Loss of time, 39 days in hospital in each case.

*Unsafe practice—Electrical contact.*—An electrician's mate, first class, touched a live wire while cleaning the switchboard and suffered an electricity burn of the abdomen and chest which resulted in 100 days in the hospital. The case was reported as due to his own negligence.

*Unsafe practice—Food-products machinery (dough mixer).*—Due to his own negligence, a marine private was struck by the paddle while operating a dough mixer, causing a simple fracture of the radius and ulna and a rupture of the spleen. He was 59 days in the hospital.

*Unsafe practice—Food products machinery (meat grinder).*—A ship's cook, third class, carelessly pushed his finger into the revolving parts of a meat grinder, resulting in an amputation of the index finger. He was 13 days on the sick list.

*Unsafe practice—Operation of laundry machinery.*—A seaman, first class, received a fracture with dislocation near the elbow joint when he put his hand into a laundry extractor before it had come to a full stop. The injury was due to his own negligence. Loss of time, 179 days in hospital.

*Unsafe practice—Cresol solution.*—A marine private received chemical burns of both hands and forearms when he attempted to wash his hands in a bucket of water containing a solution of cresol which had been used to scrub down and was carelessly left in the passageway. He was six days on the sick list.

*Dangerous practice—Improper use of bayonet.*—A marine private suffered an incised wound of the hand when he attempted to open a box of shoe polish with his bayonet. He was incapacitated for duty 92 days. The case was reported as due to his own negligence.

*Dangerous practice—Careless handling of ammunition.*—An aviation machinist's mate, third class, carelessly tapped the primer of a .30-30 cartridge. When it exploded he suffered an avulsion of the fingers of the left hand which incapacitated him for 114 days in the hospital.

*Dangerous practice—Handling of gasoline.*—A marine private suffered burns of the face and both hands when he lighted a trash pile upon which gasoline had been poured to facilitate burning. Loss of time, six days.

*Dangerous practice—Electricity (radio transformer).*—A radio-man, second class, received multiple burns from electricity when he made contact with a transformer carrying over 15,000 volts while repairing a radio apparatus. The case was reported as due to his own negligence, because he failed to ascertain whether or not the current was shut off. Loss of time, 28 days in the hospital.

*Dangerous practice—Short circuit in fuse box.*—While an electrician's mate, second class, was repairing a fuse box, he caused a short circuit with a metal instrument, which resulted in an electricity

burn of both hands. He was 14 days on the sick list. The case was reported as due to his own negligence.

*Dangerous practice—Use of unknown chemical paint remover.*—A seaman, second class, was given a quantity of commercial paint remover by another enlisted man to remove paint from his arms after he had completed painting, which resulted in chemical burns of both forearms. Loss of time, 26 days in hospital.

*Miscellaneous—Lack of safety device, power-driven saw.*—A fireman, third class, suffered an amputation of a finger when his hand was caught in a power-driven saw while sawing wood. The machine was equipped for a guard, but it was not in place when the injury occurred. Loss of time, 47 days.

*Miscellaneous—Open-hatch hazards.*—A quartermaster, second class, fell through an unprotected open hatch while carrying stores, resulting in a simple fracture of the ilium. He was 84 days in the hospital. The case was reported as due to "lack of safety device where such could be used."

*Miscellaneous—Explosion of gasoline in wash room.*—Three seamen, second class, and a seaman, first class, received multiple burns when a bucket of gasoline containing clothes exploded in the wash room. Direct cause unknown. Total loss of time, 186 days.

#### STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following table was constructed with figures taken from monthly reports submitted by naval training stations:

##### *Cumulative data*

	Number	Per cent of recruits received	Per cent of recruits reviewed
JAN. 1 TO DEC. 31, 1930			
All naval training stations:			
Recruits received during the period.....	9,222		
Recruits appearing before board of medical survey.....	677	7.34	
Recruits recommended for discharge from the service.....	269	2.92	39.73
OCTOBER, NOVEMBER, AND DECEMBER, 1931			
United States naval training station:			
Hampton Roads, Va.—			
Recruits received during the period.....	384		
Recruits appearing before board of medical survey.....	2	.52	
Recruits recommended for discharge from the service.....	2	.52	100.00
Great Lakes, Ill.—			
Recruits received during the period.....	282		
Recruits appearing before board of medical survey.....	12	4.26	
Recruits recommended for discharge from the service.....	12	4.26	100.00
San Diego, Calif.—			
Recruits received during the period.....	512		
Recruits appearing before board of medical survey.....	7	1.37	
Recruits recommended for discharge from the service.....	7	1.37	100.00
Newport, R. I.—			
Recruits received during the period.....	191		
Recruits appearing before board of medical survey.....	10	5.24	
Recruits recommended for discharge from the service.....	2	1.05	20.00

The following table was prepared from reports of medical surveys in which disabilities or diseases causing the surveys were noted as existing prior to enlistment. The time which elapsed from date of enlistment to date of medical survey is noted in each case. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office. The difficulty in establishing a diagnosis in nervous and mental cases is demonstrated by the time interval in the table. An exception in this group is epilepsy which may or may not diagnose itself promptly. Certain groups, of course, present difficulties in diagnosis at the time of enlistment due to lack of equipment:

Cause of survey	Number of surveys	Number of days between enlistment and survey
Caries, teeth.....	1	5
Constitutional psychopathic inferiority, without psychosis.....	1	253
Do.....	1	240
Do.....	1	174
Diabetes mellitus.....	1	146
Flat foot.....	1	12
Do.....	1	173
Hernia, inguinal.....	1	5
Do.....	1	3
Hernia, left inguinal, recurrent after operation.....	1	4
Do.....	1	4
Otitis, media, chronic.....	1	204
Do.....	1	5
Pleurisy, serofibrinous.....	1	240
Psychoneurosis, hysteria.....	1	187
Rhinitis, atrophic.....	1	51
Syphilis.....	1	7
Tachycardia.....	1	7
Union of fracture, faulty, right femur.....	1	21
Valvular heart disease, mitral stenosis.....	1	12

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# UNITED STATES NAVAL MEDICAL BULLETIN

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THE MEDICAL DEPARTMENT OF THE NAVY



*Issued by*  
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TRUMAN H. NEWBERRY,  
*Acting Secretary.*

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## SPECIAL ARTICLES

## PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as a means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, notes, and comments on topics of medical interest, and reviews or notices of the latest medical books.

The bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,

*Surgeon General United States Navy.*



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# U. S. NAVAL MEDICAL BULLETIN

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No. 4

## SPECIAL ARTICLES

### SPIDER POISONING: A STUDY OF THE TOXIN OF THE BLACK WIDOW SPIDER (*Latrodectus mactans*)<sup>1</sup>

By W. W. HALL, Lieutenant Commander, Medical Corps, United States Navy, and W. A. VOGELSANG, Lieutenant Commander, Medical Corps, United States Navy

The *Latrodectus mactans*<sup>2</sup> is a coal-black, shiny spider, with small cephalothorax and large, smooth abdomen. On the ventral surface of the abdomen, marked in brilliant red, is a double-triangle design in which the apices of the triangles touch, and thus outline an hour-glass. The full-grown spider averages about 1 cm in length and its smooth black legs may arch over an area of 4 to 5 cm. The spiders seen by us in California, Oregon, and Washington, or reported to us from this area, were all marked as described. This spider is known in this locality as the "black widow" spider, the name apparently arising from the female's habit of killing and eating the male after copulation. Other common names of obvious origin are "hour-glass" spider and "shoe-button" spider. The usual ventral red spots mentioned are said to vary, showing, in addition to the red hour-glass, two triangles touching base to base, four triangles arranged as a Maltese cross, only a single red spot, or one or more red spots over the back, and spinnerets in addition to the ventral red marking. Its appearance is sufficiently characteristic and so striking that once seen and recognized it is never confused with the dull-black, gray, or brown spiders. The males and immature females are variously striped and spotted with lighter markings. The young spiders are gray. Through a series of molts they gradually become darker, showing creamy white lines or spots dorsally on the abdomen, the ventral red marking appearing within a month. Maturity is not reached, however, until the following spring (1). Evidence indicates that the *Latrodectus* is the chief, if not the only, poisonous spider of North America.

Our interest in spider poisoning was first stimulated by the admission to the United States naval hospital, San Diego, Calif., of case No. 1.

<sup>1</sup> Read before the weekly staff conference, United States naval hospital, San Diego, Calif.

<sup>2</sup> Family Theridiidae, Class Arachnida.

## REPORT OF CASES

CASE No. 1.—A. F. F., officer, admitted June 21, 1931.

*History and symptoms.*—About 6.30 p. m. on the day of admission he had picked up a gunnysack in the corner of his garage in Coronado, Calif., when he felt a stinging sensation on base of left thumb which he thought at the moment to be due to a splinter of wood. His wife later examined the area in the garage and found a number of shiny black spiders with ventral hourglass red spots which were captured and identified as *Latrodectus mactans* (black widow). At 6.40 p. m. pain around area of bite and loss of strength in entire arm was noted; 6.50 p. m., pain marked in axillary glands; 7.10 to 8.45 p. m., soaked hand in hot water which relieved pain in hand and arm; 9 p. m., began to feel pain across chest, thinking the pain might be due to gas, he took some soda. Pain also developed in lumbar and sacral region; 9.15 p. m. to 10 p. m., pains in chest and back became very severe. They were apparently not muscular, as movement or massage did not affect them; 10 p. m., arrived at hospital; 10.30 p. m., given hypodermic injection of  $\frac{1}{4}$  gr morphine sulphate and atropine 1/150 gr, with slight relief; 12 p. m., morphine sulphate  $\frac{1}{4}$  gr and atropine 1/150 gr, followed by sleep.

On awakening the following morning (June 22d) he complained of pain and aching in back and legs; soreness in scalp. In the afternoon he developed pain in lower legs and feet. Feet felt numb, as if they were on the verge of going to sleep. There was perspiration on both legs below knees; movement and control of feet and legs not affected. Reflexes active. Pain and numbness gradually abated until June 26, when only occasional pain and a tired feeling of feet and legs were complained of.

On admission nothing was seen at the site of bite. Blood pressure, normal; temperature 97.4°, F; pulse, 60; respiration, 16. During the remainder of stay in hospital the temperature varied between 99.4 and 97.6° F. Pulse rose to 110 on the second day; thereafter remained between 70 and 80. Respirations approximated normal. Bowels did not move on the first day in the hospital. Laxative given, which resulted in two evacuations the following day. Treatment other than morphine noted above consisted of aspirin gr V, barbitol gr V, on the first day; luminal 3 gr morning and evening on the 23d.

Blood count: Leucocytes, 10,800. Hemoglobin, 85 per cent. Differential: Polymorphonuclears, 84; lymphocytes, 14; monocytes, 1; eosinophiles, 1. Coagulation time, four minutes. Urine: Clear; specific gravity, 1.018; acid; albumin and sugar negative. Microscopical: Much mucus; rare leucocyte.

CASE No. 2.—M. H. A., white male, age 50; occupation, rancher; residence, La Mesa, Calif., a patient of Dr. Charles W. Rees, through whose courtesy this case is here reported.

*History and symptoms.*—While sitting on the seat of an outhouse he was bitten on penis by what the patient thought was a spider. Spider not seen. Patient was brought to hospital approximately three hours after the bite in a state of impending tetany—muscles quivering and abdomen very rigid and sore. Edema of eyelids noted. Generalized muscular twitching and soreness. Skin moist, otherwise negative. Knee jerks 4 plus. Urine negative, except for the presence of occasional white blood cell and many red blood cells. Blood count: Red blood cells, 4,520,000. Hemoglobin, 90 plus. Differential: Polymorphonuclears, 87; lymphocytes, 13. Coagulation time, three minutes. Bleeding time, two minutes.

*Progress notes:* May 15th (day of admission), 6 p. m., morphine sulphate gr  $\frac{1}{4}$  given with no relief; 8 p. m., sodium amytal grs. 15 given intravenously, producing complete muscular relaxation and 20 hours' sleep. Awakened with no



pain nor muscular rigidity. Patient remained in the hospital until May 22d—six days—during which time patient was noted to have perspired freely daily. Pulse varied from 90 on admission to 65 after receiving sodium amytal, averaging about 75. The temperature from 101° F. at 8 p. m. on day of admission ranged between 98.6° and 100° F. during the next five days. Respiration varied between 20 and 24. On May 18, a fine rash was noted on body, which disappeared shortly under calamine lotion. On May 16 (two days after the bite) 20 cc immune convalescent serum (*Latrodectus mactans*) was received from the Los Angeles General Hospital and administered. No change was noted following the giving of the serum.

The symptoms of these two cases emphasize two points which seem to be characteristic of all cases of *Latrodectus mactans* poisoning reported by Brown and earlier California cases as cited by him, as well as those reported by Bogen (2): One, wherever the location of the bite may be the pain at first spreads locally and later produces distant neuromuscular and systemic effects; and two, marked abdominal rigidity and pain, which appears to be a very constant striking and important feature. Its particular importance lies in the fact that acute surgical conditions of the abdomen may be simulated. In the absence of a clear history of spider bite and a knowledge of the symptomatology, cases of spider poisoning have been operated upon for a supposed acute appendicitis, or ruptured gastric or duodenal ulcer (3).

That the appreciation of the seriousness of spider poisoning and the identification of the "black widow" as the spider to be feared in California is no new thing is brought out by the excellent article by Brown published in 1895 (4), from which we quote:

During the past 15 years I think I know of at least a dozen cases of spider bite in Pomona, and though I have taken no pains to obtain reports from other places in this section, I have heard of cases in Pasadena, Azusa, Ontario, Cucamonga, and Riverside.

The great majority of those bitten have been males, although I know of at least one female having been bitten in Pomona and one each in Riverside, Ontario, Azusa, and Pasadena. All the cases I have treated have been males, and all were bitten upon the penis. If called immediately after the bite was received, I have sometimes found at the point of greatest pain a small red spot, barely perceptible, where the poison fangs entered, but 12 or 24 hours later it was undiscernible. This fact, namely, the entire absence of redness, inflammation, or any swelling, either at the point bitten or elsewhere, I believe to be one of the most remarkable phenomena in the history of these cases. It differs in this, from the history of the effects of the bite of any other spider or animal or insect, or the action of any other poison venom of which I can learn except that of the *Latrodectus lugubris* \* \* \* found in the steppes of the Kirghuz.

In all the cases of which I am informed the person bitten while seated in the privy was suddenly seized with a sharp, severe, burning, or stinging pain on the glans penis or, as in three cases of females reported to me by other physicians, near the margin of the anus, or wherever the bite may have been. This pain increased rapidly, extending through the pelvis, sometimes to every part of the person, until in a few moments of time the suffering was almost unbearable. Some delicate patients have been nearly in convulsions before a physician could

reach them. This extreme pain has continued from one to three days, as a rule, but has shown in some cases a tendency to leave the pelvic region, in a measure, after the first few hours and manifest itself more in the lower limbs and in the abdomen and thorax, causing great precordial distress.

There is in many cases a rigidity or tonic spasm of the muscles, markedly of the abdominal muscles. There is also dyspnea, depressed and retarded heart action, small weak pulse, subnormal temperature, cold extremities, and in some cases a profuse cold perspiration. There is great anxiety and mental depression. The above conditions are found not only in the case of weak or nervous persons but also in that of the strong.

These cases are very slow to yield to medicines. The remote effects upon the nervous system and general health, are frequently marked. Pains continue to shoot through the pelvis and body occasionally for several days or weeks, and recovery is slow. Some cases have been from three to six months in recovering from the effects of this poison.

In spite of such medical testimony on the venomous and occasional fatal nature of the bites, entomologists and arachnologists have often asserted the harmlessness of spider bites.

In a masterly review of arachnidism in which he quotes 462 references on the subject, Bogen (2) cites 150 cases reported by 33 physicians in the United States from California, Virginia, Georgia, Florida, North Carolina, Alabama, Texas, Oklahoma, Maryland, Pennsylvania, Tennessee, Ohio, West Virginia, and Arkansas, two-thirds of which were from California. He sums up the symptomatology, reports 30 additional collected cases, as well as 15 from Los Angeles County General Hospital, as follows:

More than 80 per cent of the victims were males, and the majority were bitten on the penis or adjacent parts while sitting in an outdoor toilet; others on the hands, feet, or other exposed parts. All ages have been reported. A minister and a college professor have not been spared, but most of the victims were farmers or rural laborers, as might be expected from the habitat of the spider. Most of the bites occurred either in the early morning or in the evening in the summer or autumn, but this was not the invariable rule; as cases have been known in almost every month of the year. The spider actually causing the bite was captured and identified by arachnologists in about a dozen cases, but usually it was described as a shiny black spider, and the red spot on the abdomen was frequently mentioned.

A stinging or sticking sensation was noted at first, but this soon disappeared, and, except for a tiny red spot sometimes seen, there was no mark or swelling to indicate the location of the bite. In less than half an hour, however, the characteristic pain appeared, increasing in severity for several hours. It has been vividly described as intense, violent, agonizing, exquisite, excruciating, griping, cramping, shooting, lancinating, aching, and numbing, and was either continuous and incessant or paroxysmal and intermittent. It was felt in the abdomen and generally also in the legs, back, chest, and "all over," less often in the head, shoulders, and arms. The pain spreads from the site of the wound by continuity. Thus the patients bitten on the penis usually have pain in the groin and then in the abdomen, while those bitten on the wrist have pain in the arm and then the chest before it reaches the abdomen, suggesting that the venom spreads by the lymphatics and acts in the muscles rather than in the central nervous system. The final distribution of the pain, disregarding the

order of development, however, appears to be fairly uniform, irrespective of the site of the initial lesion, and the pain in the abdomen and legs follows bites of the wrist or back just as regularly as it does those of the penis or ankle.

In addition to the acute pain, which was evidenced in most cases by writhing, rolling, doubling up, muscle spasms, and paroxysmal contractions, many other symptoms were described. The most common, in the order of frequency, include profuse cold sweats, restlessness, anxiety, difficulty in breathing, anorexia, nausea and vomiting, constipation, cyanosis, delirium, prostration, shock, insomnia, speech disturbances, and acute urinary retention. Tremors, twitching, paralyses, convulsions, localized swelling of the bitten part or of other tissues, chills, dizziness, priapism, jaundice, and a macular skin eruption were also encountered.

An extreme boardlike rigidity of the abdomen was the most striking physical finding, but abdominal tenderness was rarely mentioned. Circulatory disturbances, evidenced by cyanosis and an unduly slow or rapid pulse, were often noted, but actual figures were lacking. The most acute symptoms lasted a number of hours, no relief being felt for more than six hours in half the cases reported. The pain then generally subsided in from 12 to 48 hours after the onset, but complete ease was often not secured for more than a week, and many complained of weakness and recurring pains for many weeks thereafter.

The "black widow" is a nocturnal spider, practically all bites reported having occurred in the evening or night in outdoor privies, where the spider has woven its irregular web beneath the seat, or in dark, dry corners of garages or woodsheds. As the "Chic Sale" type of outhouse architecture gives way to modern, sanitary conveniences, we may expect to have most of the bites located on the hand or foot and probably to decrease in frequency. For although the "black widow" is a vicious attacker and fearless fighter, she fights only for food or when her domain is invaded. Studies conducted in Hawaii by Dr. Nils P. Larsen, and reported in a personal communication to one of us (W. W. H.), indicate that the "black widow" found there is a cannibal, an excellent fighter, and is able to overcome both scorpions and centipedes. Spiders bred in captivity to the fourth generation still retained their poisonous bite.

#### THERAPY

A great diversity of remedies applied externally, injected hypodermically, intravenously, or given by mouth, have been used. Morphine relieves the symptoms only when large doses are used. Luminal in our case No. 1 seemed of benefit, and suggests the effectiveness of this class of compounds which Dr. Charles W. Rees demonstrated so perfectly with the intravenous injection of sodium amytal.

All these methods of treatment are of course symptomatic or palliative, and if it were possible to apply a specific antitoxin contained in immune serum, a constant and reliable therapeutic agent could be logically applied. Reasoning along this line, cases at the Los Angeles General Hospital are bled during convalescence and the

immune serum injected into subsequent spider-bitten patients. This point appeared to be one which could be definitely tested by experimental means and was at least one which had not been determined by previous experimental studies. The results of other experimental work are confusing and contradictory. Some results indicated that the bite of the *Latrodectus* was nontoxic, others that the bite was toxic and that the toxin was highly hemolytic. After reviewing these conclusions, Bogen conducted tests which indicated that the toxin was nonhemolytic. He also applied a spider to a young male white rat which developed a rigid abdomen, a humped back, sluggish behavior, and almost paralytic gait and died two days later.

#### EXPERIMENTAL WORK WITH TOXIN

Our experimental work fell naturally into three phases:

1. The study of the toxicity, the acute symptomatology, and the pathology.
2. The development of active immunity to a high level.
3. The use of this immune serum in animals bitten by the female *Latrodectus*, and the determination of its effectiveness.

*Findings.*—1. Spiders were macerated and injected subcutaneously into guinea pigs with negative results. This suggests some element in the body of the spider which neutralized the toxin present in the poison glands.

No female *Latrodectus mactans* was found in 25 used, the bite of which was not toxic. The acute symptoms developed rapidly and with remarkable constancy. The animal usually evidenced pain at the time of the bite by flinching or squealing. Symptoms developed in the following order: Rigid tender abdomen. The animal sat hunched up with back arched and fur ruffled and elevated. (Fig. 1.) The animal appeared apprehensive, highly nervous, and jumpy. Strong, spasmodic, uncontrollable contractions of legs, which often dashed the animal into the wall or would have thrown it off the table if not protected, began and increased in intensity. Difficult and noisy respirations then developed, which in the severe cases went on rapidly to a pulmonary edema in which the respirations were noisy, labored, and quantities of clear fluid escaped from the nose and mouth.

These symptoms began in from five minutes to one-half hour after the bite and ran their course in from one hour to four or five hours, when the animal either succumbed or began to improve. During the second 24 hours the pseudoparalysis, apparently due to painful movements, was marked. The coat was ruffled (fig. 2), the animal obviously sick. Loss of weight was marked during the first week



**FIGURE 1.—GUINEA PIG SHORTLY AFTER BEING BITTEN BY A BLACK WIDOW SPIDER**

Abdomen rigid and tender. Pig sat hunched up with back arched, fur ruffled and elevated. It appeared apprehensive, highly nervous, and jumpy.



**FIGURE 2.—TWENTY-FOUR HOURS AFTER BEING BITTEN BY A BLACK WIDOW SPIDER**

Animal showed a pseudo-paralysis, apparently due to pain on motion of limbs. The coat was ruffled, the animal obviously sick.

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**FIGURE 3.—SHOWING LOCAL SLOUGHS AROUND POINT BITTEN**  
The only reaction shown by immune pig to subsequent bites of the black widow spider.



**FIGURE 4.—VENTRAL VIEW OF FEMALE LATRODECTUS MACTANS (BLACK WIDOW SPIDER)**  
Showing red hourglass marking on abdomen.

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to 10 days. It was noted that the spider would occasionally, if allowed, remain with the mouth parts applied to the shaven skin of the guinea pig for two or three minutes, apparently feeding. In these animals, from which the spider apparently sucked tissue juices, the symptoms were observed to be milder in character and delayed in time of development.

Tissues of animals which died shortly after being bitten (one to five hours) showed no significant pathology other than the pulmonary edema noted. Tissues of animals which died after 48 hours showed numerous areas of necrosis and hemorrhages of liver, and rare areas in the kidney, spleen, and adrenals. No evidence of hemolytic action of the toxin was demonstrated *in vivo* nor *in vitro*. This is supported clinically by the absence of hemoglobinuria or jaundice in patients bitten by the *Latrodectus*. Routine methods demonstrated no pathology in the central nervous system. It is possible that by special staining methods changes in nerve cells might be demonstrated.

2. Following recovery from the bite of a female *Latrodectus*, complete immunity apparently was present. Subsequent bites caused no symptoms other than a local slough (fig. 3) which developed in 24 hours and crusted and healed in about a week. This is an interesting point, since humans and experimental animals when first bitten show no local reaction to the bite other than a small red spot, which soon disappears.

3. After having been bitten by eight spiders at intervals of a week or more, a guinea pig was anesthetized and bled by heart puncture; the serum from several bleedings was separated and preserved with 0.5 per cent phenol. Two guinea pigs of 300 to 400 grams weight were each bitten by a female *Latrodectus mactans* and each given 4 c c of the immune serum. This experiment was twice repeated with identical results. The first pig was given immune serum by subcutaneous injection immediately after the bite. The second was given immune serum when symptoms were well developed (one-half to three-quarters of an hour after injection); that is, when spasmodic movements of the legs or labored respirations were first noticed. The animals receiving the injections immediately showed no symptoms or only slight symptoms (rigid abdomen and restlessness). Those receiving the injection after development of symptoms were not affected at all by the immune serum and in each case died. This finding indicates that the late therapeutic use of convalescent or immune serum can have little, if any, value. As with tetanus toxin, the venom which has been absorbed and has combined with nerve tissue apparently can not be neutralized.

## SUMMARY AND CONCLUSIONS

1. The *Latrodectus mactans* (commonly called "black widow" or "shoe-button" spider) is a venomous spider, the bite of which produces in man as well as in experimental animals a chain of severe symptoms which are remarkably constant and characteristic.
2. The toxin is a nonhemolytic neurotoxin, which apparently acts on nerves and nerve endings.
3. Experimental animals bitten on the abdomen, succumbing after 48 to 72 hours, shows areas of necrosis in the liver, kidneys, spleen, and adrenals.
4. A single bite establishes immunity.
5. Immune (antitoxin) serum protects only when given immediately after the bite. Given later it does not seem to alter the course of the reaction.

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## ROUTINE ANNUAL CHEST EXAMINATION

By F. W. MULLER, Lieutenant Commander, Medical Corps, United States Navy

During a visit to the medical department of the home office of the Metropolitan Life Insurance Co., New York City, it was learned that all employees are given a preemployment and an annual physical examination. As there are many applicants for positions and about 10,000 employees, a large number of examinations are made during each year.

The company is responsible to the employee for his continued good health during his period of employment. For instance, should an employee have pulmonary tuberculosis, he is sent to the company's sanatorium at Mount McGregor. Each patient remains at the hospital for a period of six months to one year. During that time he receives two-thirds of the amount of his regular salary. The average cost for the actual hospitalization of each patient with pulmonary tuberculosis has been shown, statistically, to be about \$1,500. Con-



sidering the amount of salary paid to the employee during his absence from work, the actual cost of his hospitalization, and the salary of a person to temporarily replace him, the annual loss to the company from each case of pulmonary tuberculosis is large. From the above the importance of preemployment and annual physical examinations can be realized.

When several employees showed signs of advanced pulmonary tuberculosis soon after entering the employ of the company, it became evident that the methods used at the time of the preemployment physical examination were inadequate. The failure to recognize that an employee had early pulmonary tuberculosis at repeated annual physical examinations and that he showed signs of a far advanced condition, when it was finally diagnosed, confirmed the above opinion.

If repeated annual physical examinations failed to reveal the presence of the disease in the early stages, it was evident that a more efficient method, if possible, should be added. The fact that many of the early cases of pulmonary tuberculosis were not diagnosed at the repeated examinations should not reflect unfavorably upon the ability of the staff of physicians conducting the examinations. A physician of more than ordinary ability in physical diagnosis may fail to recognize an early case of pulmonary tuberculosis, because the disease may exist for a long period, producing advanced pulmonary lesions, with no definite physical signs. This fact has been confirmed by many authorities.

The radiographic examination of the chest by a competent röntgenologist is considered the best method of diagnosing this disease in the early stages. Unless all other methods should fail, a radiographic examination of each individual appearing for physical examination would necessitate a prohibitive expenditure. For these reasons, it was decided to include a fluoroscopic examination of the chest with each physical examination. When suspicious pulmonary lesions were found, a röntgenogram was made.

Ada Reid (1) states that "out of every three cases at present diagnosed as tuberculosis, two are being discovered before the onset of clinical activity. The total figures also show a considerable decrease in the total number of new cases diagnosed among the home office employees, which would seem to indicate that by the methods described above we have our tuberculosis problem under much better control than ever before."

TABLE 1.—*New tuberculosis among home office employees*

Discovered in year	1927		1928		1929		1930 <sup>1</sup>	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Examining room (annual).....	42	30	<sup>2</sup> 59	38	63	65	41	<sup>3</sup> 56
Rest rooms.....	96	70	93	62	33	35	32	<sup>3</sup> 43
Total.....	138	-----	152	-----	96	-----	73	-----
Number of employees.....	8,159		9,313		10,107		10,642	
Per 1,000.....	16.9		16.3		9.5		9.8	

<sup>1</sup> Figures for the entire year 1930 have been added. At the time of the original report, only those of the first 4 months were given. The report is even more favorable than was anticipated at that time.

<sup>2</sup> By fluoroscopic examination.

<sup>3</sup> Of these 43, 18 were fluoroscoped, and on the basis of these findings, were sent for X ray.

*Technique of fluoroscopic examination of the chest as routinely carried on at the home office of the Metropolitan Life Insurance Co., medical division (1).—*The use of the fluoroscope is a potential source of danger; but if the ordinary rules of protection for operator and patient are observed there should be no untoward effects. The ordinary rules include the following, namely, a machine which is well grounded, wires which are out of reach of patient or operator, a lead rubber protection, either as an apron suspended from the bottom of the fluoroscopic screen or a lead rubber apron covering the body of the operator. Lead rubber gauntlets should be worn in making every examination. The machine should be installed in a room which may be completely darkened.

We use a standard instrument with a 5-inch spark gap at 110 volts and 5 milliamperes. The time required for a complete examination varies from two to three minutes.

The physician waits in a darkened room until his eyes are sufficiently accommodated, usually two to four minutes, then views the chest in the following sequence: First, the chest as a whole, comparing right and left sides as to contour, size, and movement; next, the mediastinum and its contents, rotating the patient so that the posterior mediastinum is examined; and then the diaphragm, noting contour, freedom of motion on quiet and forced respiration, and then the costophrenic angles.

In inspecting the lung fields the diaphragm of the instrument is closed so that only an area equal to one interspace is seen—the right and left sides compared for difference in transmission of the ray. The supraclavicular muscles are pushed aside with the gloved hand, giving a clear view of the apices. The patient is told to hunch his shoulders, thus bringing the apical fields into view above the clavicle. To obtain a view of the first interspace, the arms are internally rotated so that the palms are facing outward. Each interspace is subjected to the same careful scrutiny. Rotate the patient slightly to the right and to the left—in this way very small lesions have been picked up. Then the patient is turned around and the same procedure is followed. (The value of this was appreciated after the demonstration of a small lesion near the anterior chest wall which was not seen until viewed from the posterior aspect.) Finally, the patient again faces the operator and, with eyes at their optimum accommodation, a last look is given at the apices and upper lobes.

The Annual Report of the Surgeon General, United States Navy, 1931 (2), states:

*Invalided from the service.*—Twelve officers of the Navy and one officer of the Marine Corps were retired, and 147 enlisted men of the Navy and 20 of the Marine Corps were invalided from the service because of tuberculosis.

*Chronic pulmonary tuberculosis.*—The number of cases treated was 320. Twenty-three patients died.

It is believed that a competent röntgenologist should make an examination of the chest of each applicant for admission to the United States Naval Academy as a part of the routine physical examination. Each applicant for admission as an officer of the Staff Corps of the Navy and as an officer of the Marine Corps should have the above examination. It should be remembered that this examination includes a radiographic examination of the heart, lungs, and mediastinum.

A medical officer at the training station should include a fluoroscopic examination of the chest, made by himself, as a part of the routine physical examination of each enlisted man upon his arrival at the station. The medical officer should have some instruction in the use of the fluoroscope and the dangers of overexposure to the patient and himself. Practice will make him proficient. He should refer all suspicious cases to a competent röntgenologist for further examination.

Two patients from ships in the navy yard, New York, were recently sent to the naval hospital for a radiographic examination of the chest. Both showed chronic pulmonary tuberculosis, far advanced, active, with multiple cavity formation. This has been observed several times during the past 11 years as a röntgenologist in various naval hospitals. This is no more reflection upon the professional ability of our naval medical officers than were similar cases upon the ability of the physicians on the staff of the home office of the Metropolitan Life Insurance Co., New York City. It is believed that each of the enlisted personnel of the Navy should have an annual fluoroscopic examination of his chest, with a radiographic examination if questionable findings are present. An entry of the examination should be made in the health record by the medical officer of the ship or station.

It is recommended that a radiographic examination of the chest by a competent röntgenologist be made a part of the annual physical examination of each officer of the Navy and Marine Corps. A space for the radiographic findings should be provided on the blank form.

The cost of a fluoroscopic unit is about \$800. The depreciation would be about \$100 annually. The annual cost of operation, replacement of one X-ray tube, is about \$90. So, the cost of operating a fluoroscopic unit at each training station would be about \$190 annually.

As the total number of applicants for admission as officers in the Navy and Marine Corps is indefinite, the total cost of the radiographic examinations of the chests of these applicants can not be estimated. The cost for each examination would be about \$2. At that estimated cost per person, annual radiographic examinations of the chests of 9,286 officers of the Navy and Marine Corps would cost \$18,572.

At the present time radiographic examinations of the chests of all children in the schools of Brooklyn, N. Y., are being made. A paper film is used instead of the ordinary radiographic film. The use of the paper film, which consists of a thin layer of gelatin containing a salt of silver on paper instead of a cellulose support, is a new procedure and very satisfactory for that kind of work. The paper film is in a roll. After exposure it is returned to the manufacturer for development, much the same as a roll of film for a motion-picture camera. The cost of each film, including development, is about 20 cents. By using the paper film instead of the ordinary radiographic film the annual cost of radiographic examinations of the chests of all officers of the Navy and Marine Corps would be approximately \$3,715.

Considering the cost of the above examinations, using paper films, it is obvious that the expense is not prohibitive.

#### CONCLUSIONS

1. Definite physical signs may be absent in incipient and advanced cases of pulmonary tuberculosis.
2. Where expense need not be considered, a röntgenogram, interpreted by a competent röntgenologist, is the best means of diagnosing incipient pulmonary tuberculosis.
3. Fluoroscopic examination of the chest is not an efficient substitute for a radiographic examination.
4. Pathological change in the chest, namely, of the lungs, heart, and mediastinum, can frequently be demonstrated fluoroscopically.
5. Where a large number of persons are to be examined physically and the expense of such examinations must be considered, a fluoroscopic examination of the chest should be made and all suspicious cases referred for radiographic examination.
6. A radiographic examination of the chest should be included in the physical examination of each applicant for admission to the United States Naval Academy, to the Staff Corps of the Navy as an officer, and as an officer in the United States Marine Corps.
7. A medical officer should make a fluoroscopic examination as part of the routine examination of all recruits at training stations, with a radiographic examination in all necessary cases.

8. Each of the enlisted personnel of the Navy should have an annual fluoroscopic examination of the chest, with a radiographic examination if questionable findings are present.

9. Each officer of the Navy and Marine Corps should have a radiographic examination of the chest as part of his report of the annual physical examination.

10. By using paper films instead of the ordinary radiographic films, an annual radiographic examination of the chest of each officer of the Navy and Marine Corps can be made at a cost that is not prohibitive.

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#### DIVERTICULUM OF THE ESOPHAGUS

##### WITH REPORT OF CASE

By G. A. ECKERT, Lieutenant Commander, Medical Corps, United States Navy

The first record of a case of esophageal diverticulum was made in 1764 by Mr. Ludlow, a surgeon in Bristol, England. During the eighteenth century six other references appeared in the literature from Italy and Germany.

In 1830 Sir Charles Bell first suggested the establishment of a fistula to empty the contents of the sack. In 1877 Nicoladoni practiced the procedure. Kluge in 1850 suggested complete excision of the sack. Niehaus in 1884 was given credit for the first extirpation. In 1892 Von Bergmann and Kocker each reported successful cases of extirpation. In 1896 Girard proposed a procedure in which he invaginated the diverticulum and sutured the esophageal wall. In 1909 Goldman proposed a 2-stage operation in which he freed the sack, ligated the neck, and fixed the sack to the skin. In 1918 Judd modified this by suturing the neck of the sack to the skin without ligation; 10 days later he excised the diverticulum. Wilke and Hartley modified this by incising the pouch, resecting the mucosa, invaginating the outer layer, then closing the opening with a purse string. Many more excellent articles with further modifications have been published by C. H. Mayo, Murphy, Lahey, and others.

Rokitensky in 1840 was the first to classify these diverticula into pulsion and traction types. In 1877 Zenker and Von Ziemissen after intensive studies cleared up many of the erroneous ideas concerning

the etiology and symptomatology. Since that time the pharyngo-esophageal diverticulum has often been called the Zenker diverticulum.

Reitzenstein in 1898 was the first to recognize the condition by X ray.

In 1923 there were records of less than 200 cases operated on, but since then, with improved methods of diagnosis, many more cases have been added, so it appears that the condition is not as rare as was once thought.

Diverticula of the esophagus occur most frequently in adults, rarely before the age of 45. The average age of cases reported by Judd was 55. In the cases reported by Jewett the average age was 63. The condition occurs more often in men than in women, the ratio being about 4 to 1.

Pulsion diverticula are always located at the pharyngeal dimple, a weak spot in the posterior pharyngeal wall just above its junction with the esophagus, and on a line with the cricoid cartilage. This point has been called the Laimer-Haeckermann area and is the narrowest part of the esophagus. In this area the outer longitudinal muscle coat splits into vertical bundles which pass around the esophagus and are attached anteriorly on the cricoid cartilage. This leaves a small triangular open space which is covered only by the circular muscle fibers. This space is often referred to as Laimer's triangle.

Jackson thinks that the most important etiological factor in pulsion diverticula is a spasm of the cricopharyngeus muscle, which normally pulls the cricoid cartilage back against the spine, maintaining a tonic closure of the esophageal mouth. When the cricopharyngeus fails to relax at the approach of the bolus of food forced downward by the contraction of the inferior constrictor muscle of the pharynx, this triangular space is forced out to form a pouch.

The pulsion diverticulum, which is a true hernia in that it consists of the mucous and the submucous coats, is located usually to the left of the esophagus, between the layers of the prevertebral and pretracheal fascia. This fact is of great surgical importance, as it has considerable bearing on the percentage of fatalities. When leakage occurs and the mediastinum has not become walled off, it is between these two fascial planes that it extends and produces fatal mediastinitis.

The pulsion diverticulum is pear or club shaped, or like the finger of a glove. The size varies greatly. Reichman reports a case large enough to hold 500 cc.

Prodromal symptoms which may exist for years are usually vague and obscure. They consist of expectoration of mucous, a dry and

scratchy feeling in the throat, salivation, at times a fear of swallowing because of the feeling that the food may stick in the throat.

Later, when the sack has become larger, there is inability to swallow large particles of food. Then smaller particles, until finally, in extreme cases, they are unable to swallow even fluids. Regurgitation of undigested food occurs either spontaneously, by maintaining certain positions, or by pressure with the fingers. The latter procedure produces a peculiar characteristic gurgle, which is due to the mixture of air and food in the sack. There is no pain connected with the condition unless ulceration occurs. Pressure on the recurrent laryngeal nerve may cause hoarseness. Finally, when complete obstruction occurs there is marked loss of weight and strength.

The radiological examination, using the barium meal, has proven to be the most important factor in establishing the diagnosis. The sack fills and overflows; often a fixed fluid level line shows, especially when the patient is examined in the upright position.

In the differential diagnosis we must consider cardiospasm, carcinoma, cicatricial stricture, spasms, and foreign bodies.

Traction diverticula may occur at any portion of the esophagus. The most common place is on the anterior wall of the esophagus, usually at a level corresponding to the bifurcation of the trachea. They occur at any age and frequently in tuberculous individuals. They are often multiple and are usually small, and are discovered at autopsy. They rarely cause any symptoms, due to the fact that they are either directed upward or horizontal; also the muscular coat forms part of the wall, so the sack tends to empty itself.

They are caused, as the name implies, by some outside traction, such as a broken-down lymph gland, pericarditis, pleurisy, calcicosis, caries of the vertebræ, and mediastinitis. Congenital defects possibly play a part, but Boyd states that esophageal diverticula of the congenital type do not exist.

Fortunately it is not necessary to apply any surgical procedures to this type of diverticulum. Occasionally they may cause symptoms, usually mildly obstructive, which can be overcome by dilatation.

The treatment of pulsion diverticula depends upon the size of the sack, the size of the neck, and its location. In the early stages, when the sack is small, olive-tipped bougies may be passed. Dilatation at the neck of the sack usually makes it possible for these patients to swallow more easily. However, these sacks continue to increase in size, the patient loses weight and strength, and by the time he eventually comes to operation he is not as good a risk as he would have been earlier.

Pulsion diverticula are generally surgical problems. Many types of procedures have been tried, and some discarded. Some surgeons

believe the 1-stage operation is the ideal one; others think the 2-stage is the preferable one. Most German surgeons use the 1-stage method. Shallow says: "The 1-stage operation offers the best possibility for permanent repair, because in the 2-stage operation the repair is made in much inflammatory tissue. The 2-stage operation is much safer, but far less apt to effect a permanent cure."

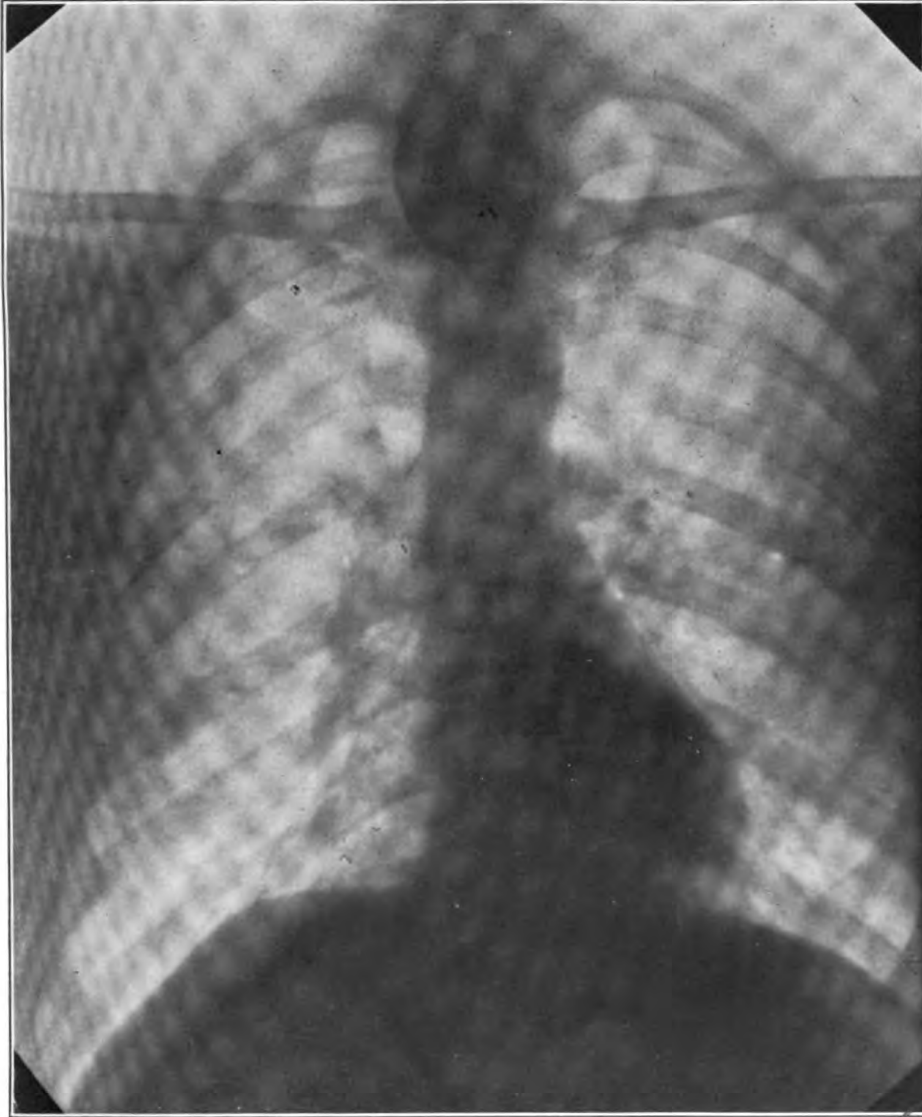
Babcock and Jackson say: "The need for a multiple-stage operation, which played an important part in the development of the operative treatment for diverticulum, has with the present technical improvements largely disappeared. Operative accidents, such as removal of an excess of esophageal tissue, secondary strictures, the leaving of the portion of the sack with the resulting recurrence, injury to the recurrent laryngeal nerve, esophageal fistula, secondary hemorrhage, and wound infection, have largely been eliminated by standardized methods."

Jackson's method of procedure is as follows: Two or three days prior to operation the patient swallows a strong silk thread which has three or four shot fastened at the end. When the X ray shows the shot to be in the ileum the patient is ready for the operation. This silk thread serves as guide for the rapid introduction of the esophagoscope.

A transverse skin incision is carried from the midline of the neck at the level of the cricoid cartilage to about the middle of the left sternomastoid muscle the incision includes the skin, superficial fascia, and platysma. The left pretracheal muscles and thyroid gland are retracted mesially the large vessels are retracted laterally. The esophagus is exposed. The esophagoscope is inserted into the sack; any liquid or particles of food are removed. The sack is pushed into the wound and is easily recognized by the light in the end of the esophagoscope. The sack is picked up with soft viscera forceps. The esophagoscope is withdrawn, and the neck of the diverticulum carefully dissected free. The sack is next excised, closed with fine black silk, reinforced with a second row of fine silk or silver wire (size No. 35) and a third row of fine silver wire or chromic gut (No. 000).

The Sippy-Bevan operation infolds the sack by means of longitudinal and transverse purse-string sutures. The sack is not removed, but is gradually folded up and turned into the lumen of the esophagus, where it either atrophies or sloughs off. It eliminates the possibility of infection and extension into the mediastinum, because the mucous membrane is not opened. This method can be employed in the cases of small sacks and frequently those where the sack is of medium size.





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DIVERTICULUM OF ESOPHAGUS. (ECKERT)





Liebl, after carefully dissecting the diverticulum free, sutured the dome of the sack to the muscular structures above the opening, thus preventing food and water from entering it.

Goldman ligated the neck of the sack tightly to insure strangulation and necrosis of the pouch, packed it high in the wound, and partially closed the skin. In a week or two he removed the sloughing sack.

Murphy described a 2-stage operation for all cases. The first stage consists of dissecting out the sack, then twisting it and suturing it in this position. He allowed granulations to form for about two weeks before he removed it.

C. H. Mayo first frees the sack, then sutures up the skin with the sack left outside in the dressing. The skin edges are sutured to the esophagus at its junction with the diverticulum. After 10 days the sack is removed and the edges turned into the esophagus.

Lahey says: "The 2-stage operation is now so safe and the second stage so easy to do, and productive of so little discomfort to the patient, that we have no interest in any 1-stage plan of removing such diverticulum."

He lays much emphasis on adequate exposure. A complete dissection of the sack is made, especially the adhesions of the sack to the longitudinal wall of the esophagus, in back and on the opposite side. This makes it possible to implant the sack in the wound so that the body is higher than the neck. He also warns against making too much traction when implanting the sack, in order that the esophagus is not pulled over to one side and angulated.

After freeing the sack of all adhesions about its neck and on all sides, he implants the sack in the wound. Catgut sutures are placed between the wall of the sack in front and the edge of the sternohyoid muscle, and between the edge of the sternomastoid and the wall of the sack in back. The angles are also closed with sutures. Care is taken that the stitches do not penetrate the walls of the sack too deeply. The skin is closed, and, if desired, also attached to the wall of the sack. The sack is then covered with sterile boric-acid strips.

Ten days later the sack is excised, leaving the mucous membrane flush with the skin. The mucous membrane is separated from the submucosa and amputated at its junction with the esophagus. The excess of sack wall is cut away and the canal is packed with a boric-acid ointment strip.

In small sacks the sinus heals in about three weeks. In large sacks it usually takes from three to six weeks. Patients, as a rule, are able to swallow immediately after the operation.

Infiltration anesthesia,  $\frac{1}{2}$  to 1 per cent procaine, preceded by morphine gr  $\frac{1}{4}$  and atropine gr  $\frac{1}{150}$ , is the anesthesia of choice.

It is no longer necessary to do a preliminary gastrostomy except in cases where the diverticulum is large, the patient extremely weak and emaciated, and when a tube can not be passed down to the stomach.

**Postoperative treatment:** Although some surgeons do not use a tube for feeding purposes, it apparently is a better procedure to insert a small duodenal tube either through the nose or mouth down to the stomach, and leave it there for 10 days or 2 weeks. Light liquid food is given on the first postoperative day every two hours. In about three weeks thicker liquids and very soft foods are given. Solid foods, even if thoroughly masticated, are not permitted until at least six weeks have elapsed.

#### CASE REPORT

**Chief complaint.**—Nervousness and difficulty in swallowing, particularly large objects; vomiting.

**Present illness.**—Patient states he has been nervous and has had difficulty in swallowing since 1919. Food seemed to lodge in his throat and started up the reflex to swallow, from which he was unable to get relief. The condition seemed to be worse at night when he retired.

Shortly after the onset the patient accidentally lowered his head between his knees and gagged himself. To his surprise, he brought up food and saliva that seemed to come from the throat, and gave instant relief. On subsequent attacks patient was always able to relieve himself in this manner. He noticed that by eating very slowly and restricting his diet to liquids he was able to avoid discomfort. As time passed and the condition progressed he noticed a loud gurgling sound on swallowing, which made the patient so sensitive that he would never eat away from home. He noticed at times that he would bring up food that he had eaten three days before and that it would be in a stage of fermentation and decay.

About one year prior to admission he noted that after retiring he would have a sense of suffocation. During these periods his voice would vary from a huskiness to hoarseness. He has lost about 25 pounds in the past year.

**Past history.**—Scarlet fever, measles, and chicken pox when a child; influenza in 1918. Venereal history negative.

**Family history.**—Negative.

**Physical examination.**—Negative, with the exception of a slight fullness on the left side of the neck. Pressure over this fullness produced a peculiar gurgling noise.

X ray of the esophagus showed a diverticulum just inferior to the epiglottis. The sack extends downward posterior to the esophagus and is about 3 inches long.

**Operation.**—October 21, 1931, under local anesthesia. An incision was made on the left side of the neck along the anterior border of the sternocleidomastoid from just above the level of the cricoid cartilage down to the sternum. The edge of the sternomastoid was dissected free and retracted outward. The thyroid gland was next recognized and retracted mesially, the internal jugular vein and the common carotid artery laterally. The esophagus now presented, showing a diverticulum about the size of a lemon on the posterior aspect at about the level of the cricoid cartilage. This diverticulum was completely

dissected out (the neck was about the same size as the body) and tied off securely with heavy chromic catgut. Sutures were placed in the fundus and in the muscular structures above, so that the body of the diverticulum was higher than the neck. Rubber drain inserted and skin closed with clips. A small feeding tube was inserted through the nose into the stomach.

On his return to the ward the patient was started on 2-hour feedings of clear liquids. The tube was kept in for about three weeks; then it was removed and patient allowed to swallow liquids. The diverticulum sack sloughed off and was discharged from the wound on the tenth day. A small fistula developed, so the tube was again inserted and allowed to remain for another two weeks, when the patient was put on soft diet. One month later the fluoroscopic and X-ray picture showed the fistula completely healed. Three days subsequently he developed a severe pharyngitis with a deep productive cough and returned to the hospital with a small leak of fluid from the fistula. The tube was reinserted for two weeks and the leak stopped immediately. Since then he has been on soft food and regular diet with no recurrence.

#### SUMMARY

1. Pulsion diverticula are no longer considered rare.
2. The operation may be done in one or two stages.
3. It usually takes from four to eight weeks before complete healing takes place.
4. Acute respiratory conditions can increase the pressure within the pharynx and delay healing.

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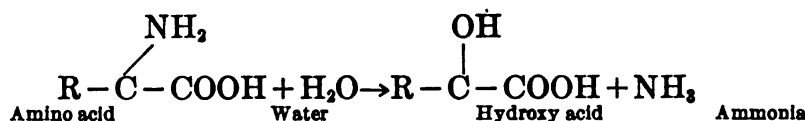
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## THE BLOOD UREA CLEARANCE AS A TEST OF RENAL FUNCTION

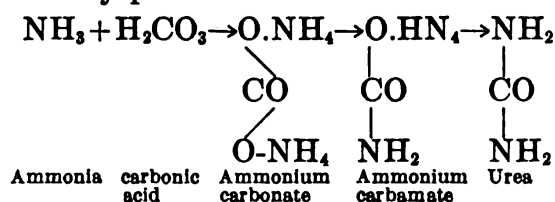
By D. J. CRACOVANER, Lieutenant (Junior Grade), Medical Corps, United States Navy

### INTRODUCTION

Under normal conditions the formation of urea from amino acids probably takes place in two stages. In the first stage there is a deamination of the acid with the liberation of ammonia:



The ammonia immediately combines with the carbonic acid always present in the body fluids. In the second stage the ammonium carbonate thus formed is converted into urea, ammonium carbamate being an intermediary product:



This conversion of the amino groups of the amino acids into urea is thought to take place in the liver (1). To what extent other tissues of the body perform a similar function has long been a subject of controversy. However, the recent work of Bollmann, Mann, and Magath (2) indicates that the sole locality of urea synthesis is the liver.

The determination of blood urea was introduced into clinical medicine by Straus (1902) and Widal and Javal (1904). This event stimulated the thought that if some relation could be demonstrated between the concentration of urea in the blood and the amount excreted in the urine, this might furnish a basis for measuring accurately the ability of the kidney to excrete this class of waste products, and so serve as an index of the functional status of the kidney. Many such indices have been presented since then, the more important of which have been the concentration ratio of Gréhan (1904) (3),

the Ambard coefficient (1912) (4), and the McLean urea secretory index (1915) (5) (6). These formulæ proved unsuitable for clinical use, being criticized both on theoretical grounds and because of their inconstancy even for a given individual (5) (6) (7) (8) (9). In 1916 Addis and Watanabe (7) suggested the use of the ratio

$$\frac{\text{grams urea in one hour's urine}}{\text{grams blood urea per 100 cc}}$$

in the evaluation of renal function. The average ratio for normal adults was shown to be 50.4. Theoretically, when the amount of renal tissue varies, the ratio is directly proportional to the amount of secreting tissue in the kidney. This has been demonstrated to be true under the specific conditions prescribed by Addis, which, in effect, assures large quantities of urine. In 1922 Addis (10) presented a method (which has come to be known as the urea tolerance test) in which various amounts, usually about 30 grams, of urea are given with large quantities of water, and the concentration of the urea in the blood and the urine is determined after unit periods of time (one hour). The method of interpretation of this test is similar to that of the glucose tolerance test. And from a theoretical standpoint this is a most logical test, in that it calls forth all the kidney reserve; but this very fact proves the test disadvantageous, in that it puts a strain, which may prove harmful, on what may be an already weakened kidney function.

#### THE BLOOD UREA CLEARANCE TEST

Investigations by Marshall and Davis (1914) (11) and Pepper and Austin (1915) (12) showed that when the urine volume is fairly large the rate of urea excretion is directly proportional to the blood urea content. Expressed in other words, with abundant urine the urea excretion per minute equals the urea contained in a constant volume of blood. This volume of blood in a normal adult is about 75 cubic centimeters. Austin, Stillman, and Van Slyke (1921) (13) demonstrated in three normal subjects that the direct ratio between blood urea content and urea excretion rate holds only when the urine volume is above a certain limit, about 2 c c per minute in adults, which they called "the augmentation limit." On the basis of these studies, in 1928 Möller, McIntosh, and Van Slyke (14) offered as a measure of the urea excreting power of the kidneys a test, which they termed "the blood urea clearance," which appears both simple and satisfactory.

The blood urea clearance test indicates the cubic centimeters of blood per minute cleared of urea by renal excretion.

*Procedure.*—Patients should not drink tea or coffee during the collection of specimens. Specimens of urine and blood are collected during the morning hours as follows:

(a) All urine is collected from 8 to 9 a. m., this specimen being labeled control. All urine is collected from 9 to 10 a. m., this specimen being labeled first-hour specimen.

Five cc of blood is drawn at exactly 10 a. m. (place in oxalated flask).

All urine is collected from 10 to 11 a. m., this specimen being labeled second-hour specimen.

All specimens are sent to laboratory.

(b) The control specimen is discarded, as this is collected for the purpose of emptying the bladder before collecting the first and second hour specimens.

(c) The amount of urine is determined in both the first and second hour specimens.

Calculate the volume of urine excreted per minute.

(d) Run urea nitrogen on blood filtrate. Multiply the number of milligrams of urea nitrogen by the factor 2.14 to convert to milligrams of urea per 100 c c of whole blood.

(e) Run urea nitrogen on both first and second hour specimens of urine. Determine number of milligrams of urea per 100 c c on both the first and second hour specimens.

Calculate average number of milligrams of urea per 100 c c of urine.

Thus we have the three factors in Van Slyke's formula:

U=Urea in urine (mg. per 100 c c)

B=Urea in blood (mg. per 100 c c)

V=Volume of urine (c c per minute)

The authors present a variation in their formula, dependent upon whether or not the urine volume is above or below the "augmentation limit"; that is, 2 c c per minute.

When the urine volume output is above 2 cc per minute, urea excretion proceeds at maximum speed, and the output per minute represents the urea content of a maximum blood volume. This blood volume, averaging in normal men about 75 cc per minute, is called the "maximum clearance." It represents the volume of blood which is cleared of urea during one minute's kidney excretion when the urine volume is large enough to permit a maximum urea output. The value of the maximum clearance (Cm) is calculated from the observed urea concentrations of the blood and urine (B and U) and the urine volume in cc per minute (V).

Thus:

$$\text{Maximum clearance (Cm)} = \frac{UV}{B} = \text{cc of blood cleared of urea}$$

The concentration ratio  $\frac{U}{B}$  indicates the number of cc of blood the urea content of which is present in 1 cc of urine.  $\frac{U}{B} \times V$ ,



therefore, indicates the number of cc of blood represented in the urea content of  $V$  cc of urine excreted in one minute. It has been determined that the mean value of the maximum clearance for normal adults in 75 cc of blood cleared of urea per minute. The percentage of the average normal  $C_m$  is obtained by dividing the individual  $C_m$  value by the mean normal  $C_m$ , 75, and multiply by 100; thus:

Maximum clearance ( $C_m$ ) (when  $V$  is above 2 cc per min.)

$$= \frac{100}{75} \times \frac{UV}{B} = 1.33 \times \frac{UV}{B} = \% \text{ of normal}$$

When  $V$ , the number of cc of urine excreted per minute, is below 2 cc, the volume of blood cleared of urea (blood urea clearance) is not constant, but decreases with diminishing urine volume. Diminishing the urine volume to one-fourth was found to lower the clearance to one-half; in other words, the clearance varies in proportion to the square root of the urine volume. In order to compare excretions below the augmentation limit (2 cc per minute), therefore, they must be compared with a constant, standard urine output; or if compared with other urine volumes, the excretion rates must be corrected for the urine volume effect. It is practically impossible to fix the urine volume at a definite standard, but by means of the square root rule of Austin, Stillman, and Van Slyke the urea excretion that would accompany such a standard urine can be calculated from the excretion measured with other volumes per minute.

The formula for this calculation the authors developed as follows:

If  $C$  is the observed blood urea clearance (the cubic centimeters of blood, the urea content of which is excreted in one minute) with any urine volume output ( $V$ ) below the augmentation limit (2 c c), then with the standard urine volume ( $V_s$ ) the corresponding standard clearance ( $C_s$ ) may be calculated by the square root rule as—

$$C_s : C = \sqrt{V_s} : \sqrt{V}$$

or

$$C_s = C \sqrt{\frac{V_s}{V}}$$

The standard urine volume adopted by Möller, McIntosh, and Van Slyke was 1 c c per minute. This not only simplifies calculation because it is represented by unity, it presents itself also as a natural standard because it is the average rate of urine excretion for normal adults (1,440 c c for 24 hours). Addis (15) found 1,345 c c as the average. Consequently the observed volumes will on the average differ less from it than from any other volume. Substituting, therefore, 1 for  $V_s$ , we obtain

$$C_s = C \sqrt{\frac{1}{V}}$$

For convenience in calculation it is desirable to substitute in place of the observed clearance (C) figures directly determined by analysis, viz, the urea concentrations, U and B, in urine and blood, respectively, and the urine volume V. As shown in connection with the calculation of the maximum clearance, the observed clearance is estimated as  $C = \frac{UV}{B}$ . We therefore substitute  $\frac{UV}{B}$  for C in the equation  $C_s = C\sqrt{\frac{1}{V}}$  and obtain:

Standard blood urea clearance =  $C_s = \frac{U}{B}\sqrt{V}$  = cc of blood cleared of urea  
(When V is less than 2 c c per min.)

It has been determined that when the urine volume was less than 2 cc per minute in normal individuals the average blood urea clearance is 54 cc per minute. Thus the percentage of the average normal  $C_s$  is obtained by dividing the individual  $C_s$  by 54 and multiplying by 100; e. g.,

Standard clearance ( $C_s$ ) =  $\frac{100}{54} \times \frac{U\sqrt{V}}{B} = 1.85 \frac{U\sqrt{V}}{B}$  = % of normal  
(When V is less than 2 cc per min.)

The square root of urine volume under 2 cc per minute:

$\sqrt{0.2}$ cc.....	0.45	$\sqrt{0.8}$ cc.....	0.89	$\sqrt{1.4}$ cc.....	1.18
$\sqrt{0.3}$ cc.....	.55	$\sqrt{0.9}$ cc.....	.95	$\sqrt{1.5}$ cc.....	1.23
$\sqrt{0.4}$ cc.....	.63	$\sqrt{1.0}$ cc.....	1.00	$\sqrt{1.6}$ cc.....	1.27
$\sqrt{0.5}$ cc.....	.71	$\sqrt{1.1}$ cc.....	1.05	$\sqrt{1.7}$ cc.....	1.30
$\sqrt{0.6}$ cc.....	.78	$\sqrt{1.2}$ cc.....	1.10	$\sqrt{1.8}$ cc.....	1.34
$\sqrt{0.7}$ cc.....	.84	$\sqrt{1.3}$ cc.....	1.14	$\sqrt{1.9}$ cc.....	1.38

The standard clearance indicates the efficiency with which the kidneys excrete urea when the urine volume is at the average normal level of 1 cc per minute. The maximum clearance indicates the maximum efficiency of urea excretion with high urine volumes.

For subjects differing markedly from usual adult size, a correction is introduced by multiplying the observed V value by the factor

$\frac{1.73}{\text{Sq. meters surface area}}$  and using the V value thus corrected for calculation of either  $C_m$  or  $C_s$ .

A percentage of 80 or above is considered a normal urea clearance. Below 80 per cent indicates decreased kidney function.

#### INTERPRETATION OF THE TEST

The classification of the nephritides in the following discussion is that of Addis (16). The conclusions are based on data presented by Van Slyke, Stillman, and associates (17) from a comparison of the terminal blood urea clearance values with the post-mortem findings.

In hemorrhagic nephritis (glomerulonephritis) and degenerative Bright's disease (nephrosis) the blood urea clearance is interpreted as a measure of the proportion of glomerular tissue still functioning; in arteriosclerotic kidney disease the fall in blood urea clearance is proportional, not to the glomerular destruction, but to the decrease in the renal blood flow resulting from reduced caliber of the arterioles. In cardiac decompensation the decrease in blood volume flow is again responsible for reduced urea excretion.

*Hemorrhagic nephritis (glomerulonephritis)*—Acute stage: During the first two months after the onset of the acute stage it is usual to obtain a fall of the blood urea clearance to 50 per cent or less of normal. The maintenance of a normal clearance during the first months of the disease does not justify a good or bad prognosis. Those cases showing no decreased clearance may progress into the chronic stage with gradually failing function, and eventually reach the terminal stage. A good prognosis during acute hemorrhagic nephritis can only be predicated upon the urea clearance, if it has fallen, returning to normal within four months; or if it has not fallen, to continue to remain normal for that period of time. Usually, if a normal clearance is not regained the progress of the disease continues.

Chronic stage: This stage of the disease may be either latent or active. The latent period is that phase reached by patients who improve until subjectively symptom-free, but in whom a persisting hematuria or albuminuria indicates some residue of injury remaining, and during which the urea clearance is usually normal. In the chronic active stage the blood urea clearance is usually less than 40 per cent. It might remain practically stationary for more than a year, but eventually, however, it always resumes a downward course. In the terminal stage of the disease, after the clearance had fallen permanently below 20 per cent of normal, Van Slyke et al. (17) report that, out of 18 cases observed, 11 died in less than one year, 5 in between one and two years, and 2 survived two years by a few months. Uremic symptoms were uniformly absent when the clearance was above 10 per cent of normal but were uniformly present when it sank to the neighborhood of 5 per cent.

*Degenerative nephritis (nephrosis)*.—In nephrosis the blood urea clearance falls below normal, with a tendency to chronic progress downward. These cases may terminate in uremia, with gross nitrogen retention and other typical signs of uremia, but without at any time showing hypertension or hematuria. The glomeruli become involved in the degenerative process but never show inflammatory changes. In these cases the blood urea clearance falls, as in hemorrhagic nephritis and arteriosclerotic kidney disease, to the neighborhood of 5 per cent before uremic symptoms ensue.

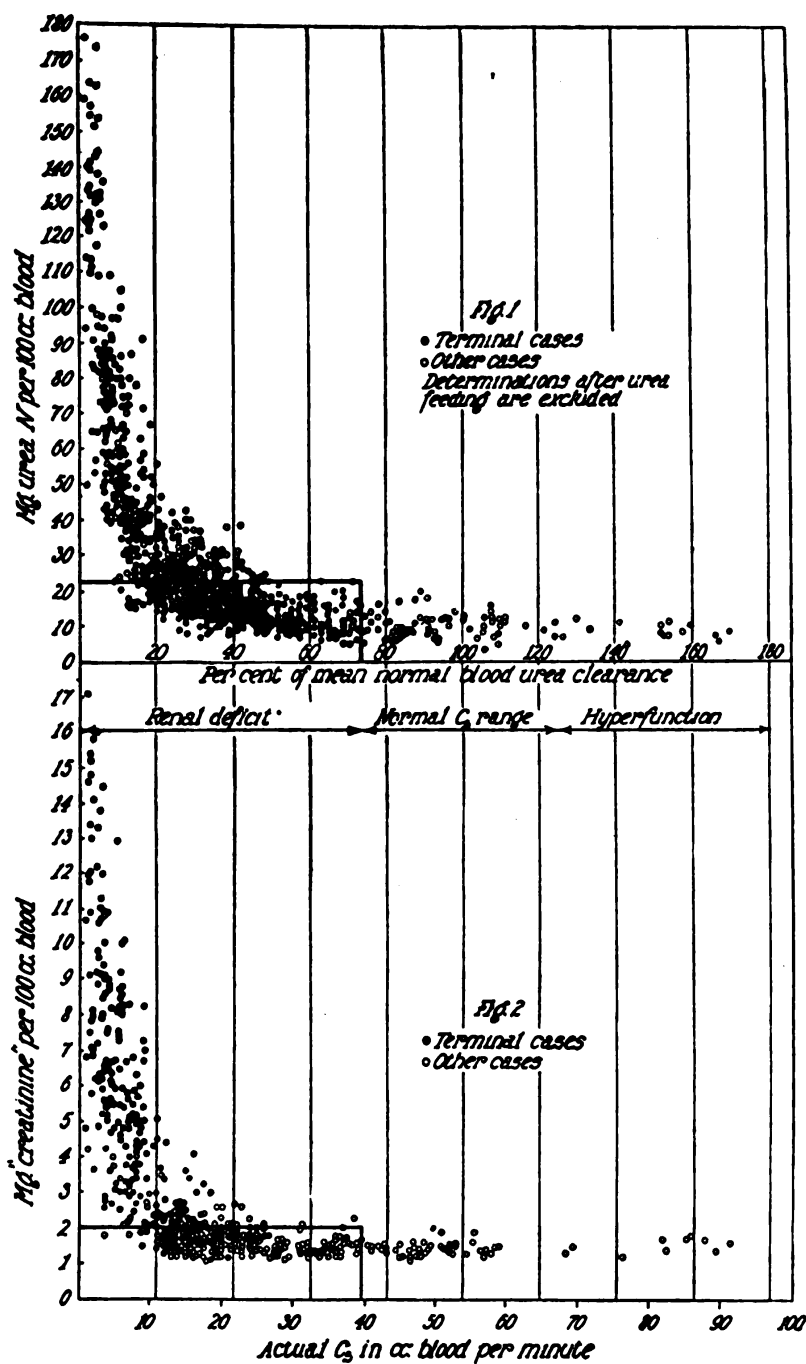
*Arteriosclerotic kidney disease.*—This condition may continue for years without lowering the blood urea clearance. Eventually, however, a fall in urea clearance occurs, and the end result is uremia, unless vascular or cerebral accident terminates the case before renal failure has reached the uremic stage.

COMPARISON OF THE BLOOD UREA CLEARANCE WITH OTHER MEASURES OF RENAL FUNCTION

The following is taken from the original work of Van Slyke, McIntosh, Möller, Hannon, and Johnston (18), based on some 60 cases of nephritis, representing all three types, selected from nephritic patients observed for several years at the hospital of the Rockefeller Institute of Medical Research. Möller, McIntosh, and Van Slyke (19) found in the wards of that hospital consistently normal blood ureas in nephritic patients who had lost 40 to 60 per cent of their renal function. Such patients are likely, either by choice or direction, to take diets low in protein; and if they consume half as much as a given normal subject, other factors being equal, they will show about normal blood urea content. If, in addition, they drink more water, they may have even less blood urea than many normal subjects.

The data in Figure 1 serve as illustration and proof of this. All the points within the rectangle indicate observations in nephritic cases in which the blood urea clearance had sunk below the minimal normal value, and in which the blood urea contents were nevertheless within the normal range. It is seen that until the blood urea clearance has fallen below 50 per cent of the average normal, all the blood urea contents were within the rectangle. With clearances between 20 and 40 per cent of average normal, more than half the blood urea contents are still within the normal maximum. It is only when renal function, as measured by the clearance, has fallen to less than 20 per cent of normal that a great part of the blood urea concentrations become definitely elevated. These results illustrate the uncertainty which attends the interpretation of normal blood urea concentration values in nephritic patients if urea excretion is not also taken into consideration. After nephritis has progressed sufficiently far to cause a permanent elevation in blood urea nitrogen, the latter is likely to undergo variations which are obviously unrelated to any essential change in the pathological process of the kidneys.

Figure 2 gives results of a comparison of blood creatinine determinations with blood urea clearances. The remarks made above concerning the relative insensitiveness of the blood urea concentration as an indicator of developing renal insufficiency can also be applied to blood creatinine.



FIGURES 1 and 2.—Relationship of blood urea nitrogen concentration and blood creatinine concentration to blood urea clearance in nephritic patients. The points enclosed in rectangles represent urea or creatinine values found within normal limits when the renal function, measured by the blood urea clearance, was below the normal minimum. The numbers indicating percentages of normal clearance and corresponding to the vertical lines through both charts, are at the bottom of the upper chart. (From Van Slyke, McIntosh, Möller, Hannon, and Johnston. Jr. Clin. Invest. 8: 357, 1930)

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## SUMMARY

1. It appears that in the blood urea clearance we have a simple and easily applied test of renal function.
2. The blood urea clearance correlates the blood urea level with urea excretion, and urine volume. A decrease in the average normal values expresses a pathological deviation of the physiological function of the kidney.
3. The blood urea clearance is apparently more sensitive than the urea and creatinine concentrations of the blood in detecting the earliest signs of kidney disease.
4. The blood urea clearance appears to be of definite prognostic value.

## CONCLUSION

There is presented herewith an exposition of the blood urea clearance test. Its general use in the service is suggested so that its superiority as a test of renal function may be confirmed.

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THE VALUE OF IMMEDIATE FULL RESTORATIONS AND PREEEXTRACTION RECORDS

By S. S. JAFFE, Lieutenant Commander, Dental Corps, United States Naval Reserve

The purpose of this article is to set forth the results of a number of years of research and practice in the field of prosthetic dentistry which have led the writer to two conclusions.

1. That the immediate full restoration of teeth presents so many advantages, both from the standpoint of the patient and the dentist, that it should become a universal practice.

2. That the taking of accurate preextraction records is so urgent a necessity in the practice of full denture prosthesis that it should become an elementary rule of the profession.

Let us consider the two matters separately, although they are interrelated to the extent that an accurate preextraction record is essential to the immediate replacement of dentures.

#### IMMEDIATE FULL RESTORATIONS

By immediate full restorations is meant the extraction of the patient's teeth and their replacement by artificial dentures during the same sitting in the dentist's chair. In merely defining the term I realize that I break sharply with the widespread belief that a person must go many weeks or even months edentulous before restoration can be attempted. Yet I am convinced that only the ignorance of the general public has let this belief go unchallenged. I am further confident that if the advantages of immediate restorations were fully understood throughout the profession many dentists would adopt this technique. Let us consider the advantages of immediate dentures from the standpoint of—

(1) *The patient.*—The edentulous period, lasting sometimes as long as three months under the dictates of established practice, is one of acute suffering, both physical and mental, for the average patient.

Having lost his natural teeth and having no substitutes, the patient soon finds his mandible in a dislocated position. Thus the whole appearance of his face is changed. He feels strange and unnatural. He dislikes to meet his friends. A period of intense morbidity sets in and sometimes leads to grave mental maladjustments.

And, as though this condition were not enough, the toothless patient finds it very difficult to enunciate clearly. Even when restoration is made later, it is likely that the natural lingual relationship between tongue and teeth can not be exactly duplicated and the patient must learn to enunciate anew.

When immediate restoration is made, however, and absolute accuracy of replacement is assured by means of the lingual matrix (described later), these trials are abolished. The patient, soon after having his original teeth extracted, has them replaced immediately by artificial duplicates. As he is never seen, either by himself or his friends, in an edentulous condition, he avoids embarrassment and resulting morbidity. Further, as his artificial dentures are a replica of his original teeth, and as the correct lingual relationship between tongue and teeth is preserved, the patient finds no difficulty in enunciating.

(2) *The dentist.*—The advantages of immediate replacements from the standpoint of the dentist are no less marked. His prime purpose, of course, is to extract the patient's original teeth and replace them with satisfactory artificial dentures with a maximum of efficiency and a minimum of trouble for himself and of suffering for his patient.

When immediate restoration is practiced, postoperative pain is reduced. The dentures act as a splint or bandage. They are fitted immediately following extraction and thus protect the alveoli against trauma and infection.

Immediate replacement, further, halts postoperative bleeding. Cases of excessive bleeding cause worry to all of us. Usually we attempt to stop loss of blood by using a compress, but it is not convenient to hold one long enough for it to be effective, and, in fact, it is difficult to stop bleeding at all by this means. But a denture, immediately placed, fits over the bleeding area, acts as a bandage, and helps to support the blood clot.

An immediate denture supplies proper occlusal rest and thus helps to maintain the proper intermaxillary relationship. Hence the patient does not suffer muscle fatigue, impaired hearing, or similar ills. The muscles of mastication function as usual and the habitual functional paths are kept intact.

The alveolar process is conserved by immediate dentures. This is true because the alveolar ridge does not absorb so readily as when replacement is delayed. Rather, it develops into a more favorable base. The denture affords comfort to the patient by supplying a slight, uniform pressure on the alveolar ridge. And, while long periods of sustained pressure would cause absorption of the bony base, intermittent pressure accelerates calcification.

Finally, and perhaps most important, with immediate replacement centric relationship can be more easily established.

*Looking backward.*—With these advantages of immediate replacement so obvious, why is this practice not more widespread? The answer, I think, is simple. Until recently—say 10 or 15 years ago—the dental profession as a whole showed but little interest in advanced full denture work, and the methods of practicing it were incompetent. For example, impression technique was faulty, balanced articulation was not understood, and there was no thoroughly reliable method of taking preextraction records. Now, however, with our modern precision technique, there is no reason why every dentist should not practice immediate full denture work.

The last point—the taking of accurate preextraction records—is so important in the field of full denture prosthesis that the writer would like to discuss it at some length. It is the basic point in the technique of immediate full restorations which will be outlined later.



## PREEXTRACTION RECORDS

Perhaps the practitioner of full denture work is too prone to forget that the satisfaction of his patient depends largely on one thing, namely, the extent to which the dentist preserves his patient's natural facial appearance and his facility of enunciation without necessitating a trying period of readjustment. The patient, too, is concerned with masticatory comfort.

The realization of all these aims, it appears to me, depends on the precise reproduction of the natural teeth and the maintenance of their proper relationship, and more and more dentists are coming to realize that these ends can be achieved only through accurate pre-extraction records.

Let me note here, by way of parenthesis, a modern tendency which is making preextraction records increasingly important. We all are aware of the current theory of focal infection which has become so widespread during the last 15 years. Many men reading articles warning them of the danger to general health which is said to lurk in the teeth become insistent on having their teeth X rayed, with the result that dentists everywhere are forced to adopt this practice. In like manner, the spread of knowledge among laymen as to the importance of preextraction records soon is likely to compel dentists to be prepared to take these records accurately before attempting to extract teeth.

Several methods of taking preextraction records are in use to-day. Perhaps the most outstanding are the methods which employ a wax mask of the face, photographic records, or a profile of exact size which is cut out and fitted to the face.

Now, there are objections to all of these methods. First, they require elaborate and costly equipment; second, in using them the teeth can only be positioned by measurement and by visual comparison. And in using these methods we can not be sure that the artificial dentures are in exactly the same cranial position as were the natural teeth.

By considerable research and experiment the writer has devised a lingual matrix which, as a result of long use, has demonstrated that it will insure the absolute positioning of teeth just as they were before extraction. Further, this matrix may be used without special equipment.

Another point worth stressing is that by using this lingual matrix the dentist is able truly to position the teeth whether he is practicing immediate denture technique or whether replacement is delayed. Uniform thinness of the palate is preserved, as well as the lingual anatomy of the teeth. The matrix assures not only comfort of the

tongue but also perfect enunciation. Further, the labial and buccal outlines are kept in the position where nature placed them before extraction. Thus naturalness of expression—which, as I observed previously, is of primary importance to the patient—is preserved.

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THE CLINICAL APPLICATION OF THE KAHN REACTION IN THE UNITED STATES NAVY<sup>1</sup>

By J. M. McCANTS, Lieutenant Commander, Medical Corps, United States Navy

After a careful study of the Kahn reaction by Lieut. Commander J. E. Houghton, Medical Corps, United States Navy, this test was officially adopted in 1925 as the standard serological test for syphilis. Since that time the Kahn reaction has had a thorough trial throughout the naval service and has supplanted the Wassermann and its modifications as the method of choice. In several of our larger institutions, as will be explained later, some modification of the Wassermann is still in use as a parallel test to the Kahn.

The Kahn reaction in this article will be discussed from the viewpoint of several representative naval institutions to give an idea of the use and value of this test in the Navy as a whole. In the preparation of this data, however, we have freely drawn upon the experience of other naval medical officers, notably that of Rear Admiral E. R. Stitt, Capt. C. S. Butler, Lieut. Commander John Harper, Lieut. Commander R. R. Gasser, Lieut. Commander J. E. Houghton, Lieut. Commander W. W. Hall, Lieut. Commander J. H. Chambers, and Lieut. H. M. Walker, but the compilation of clinical and serological data is our own.

At the Naval Medical School the Kahn reaction is performed as a daily procedure for the naval medical activities of the District of Columbia. Also, sera from remote activities are frequently submitted for a check test. In addition, the school acts as a central laboratory regarding this test in the following manner: 1. Clinical laboratory technicians are trained here with due emphasis on the Kahn test. These men are later assigned to duty in our various clinical laboratories and on board ships. 2. The Kahn antigen for the Navy is prepared and standardized at the school. A sample of each antigen prepared is submitted to Doctor Kahn's laboratory at the University of Michigan, Ann Arbor, for a check against his standard before issue to the various medical activities of the Navy. 3. The Kahn technique as used at the school is issued to the service in pamphlet form. In this manner the Naval Medical School promotes a uniform and a standard technique throughout the naval service. This, we feel, is a distinct advantage over the Wassermann technique

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<sup>1</sup> From the laboratories of the U. S. Naval Medical School, Washington, D. C.

and its modifications which seem to be further modified by everyone performing a complement fixation test for syphilis.

At the school the standard Kahn procedure is performed on every admission to the local naval hospital and on other sera as submitted. The Neill modification of the Wassermann is likewise done routinely, but the Kahn is considered the official and the standard test. Some modification of the Wassermann is also performed in several of our larger hospitals. Smaller activities rely entirely upon the Kahn.

There are several distinct reasons for doing both the Kahn and a Wassermann routinely in our larger institutions: 1. The Wassermann acts as a check on the more sensitive and more specific Kahn. 2. Rarely the Wassermann is positive when the Kahn is negative. 3. We do not desire to forget the technique of complement fixation around which has been built such a vast and valuable literature, and especially in view of the fact that complement fixation is also used for purposes other than the diagnosis of syphilis. We report both the Kahn and the Wassermann to the clinician on a single form for comparative purposes. All sera giving a + + + + Kahn reaction are subjected to the quantitative Kahn procedure. The same procedures are likewise applied to spinal fluids, but the quantitative Kahn on such fluids has not been done routinely.

In comparing the Kahn reaction and the Neill modification of the Wassermann test and in correlating the Kahn with available clinical and autopsy data we have noted the following points:

*Sensitiveness.*—So far as the acetone-insoluble antigen is concerned we have found it to be so far inferior to the Kahn that we have discontinued its use and now use only the cholesterolized antigen in the Wassermann test. It was frequently found to require a 20-unit Kahn serum to give a positive of any degree with the acetone-insoluble antigen. With the cholesterolized antigen, on the other hand, the Wassermann is found to compare much more favorably with but still inferior to the Kahn reaction. In an analysis of the last 2,000 sera subjected to the Kahn and the Wassermann reactions the following comparative figures are given:

- (1) Kahn and Wassermann negative with----- 1,704 sera, or 85.2 per cent.
  - (2) Kahn or Wassermann positive or doubtful with-- 296 sera, or 14.8 per cent.
  - (3) Of the 296 sera mentioned the Kahn was + + + + with 164. Assuming that the Kahn approaches the ideal method, the results may be tabulated as follows:
- |  |                             |
|--|-----------------------------|
| Kahn + + + + with-----                             | 164 sera, or 100 per cent.  |
| Wassermann positive or strongly positive with----- | 152 sera, or 92.6 per cent. |
| Wassermann weakly positive with-----               | 10 sera, or 6.1 per cent.   |
| Wassermann negative with-----                      | 2 sera, or 1.2 per cent.    |

(4) Likewise considered the Kahn was +, ++, or +++ with 115 of the 296 sera, expressed as follows:

Kahn +, ++, or +++ with.....	115 sera, or 100 per cent.
Wassermann positive or strongly positive with.....	20 sera, or 17.4 per cent.
Wassermann weakly positive with.....	18 sera, or 15.6 per cent.
Wassermann doubtful with.....	1 serum, or 0.9 per cent.
Wassermann negative with .....	76 sera, or 66.0 per cent.

(5) Of the 296 sera certain doubtful tests are expressed:

Kahn doubtful (plus-minus) with.....	7 sera, or 2.4 per cent.
Wassermann doubtful with.....	3 sera, or 1.0 per cent.
Both doubtful with.....	1 serum, or 0.3 per cent.

(6) Likewise there were a few reactions in which the Wassermann was positive and the Kahn negative:

Wassermann strongly positive, positive, or weakly positive with.....	6 sera, or 2 per cent.
Kahn negative with.....	6 sera, or 2 per cent.

We therefore feel that the Kahn test is far more sensitive than the Niell modification of the Wassermann using cholesterolized alcoholic beef-heart antigen in the latter. While there is close agreement between the tests on strongly positive sera, using a sensitive antigen in the Wassermann, there is a wide discrepancy in favor of the Kahn on all sera giving less than a ++++ Kahn reaction. This is in large measure due to the effects of treatment, since we have observed that the Kahn reaction remains positive much longer than does the Wassermann on patients undergoing specific therapy. In this particular series many of the sera were from patients who had been on anti-syphilitic treatment. It has been noted that the Kahn usually, with but few exceptions, becomes positive earlier than does the Wassermann in cases of primary syphilis. In the above series a number of tests are duplicates. The series of 2,000 sera does not represent that many individuals.

*Specificity.*—Of the 286 sera above giving reactions varying from +— to ++++ the clinical records were available in 252 and reviewed. There were only two cases which showed no history or clinical evidence of syphilis, and the reactions reported on these two cases were +— (doubtful). Of the six cases showing a positive Wassermann and a negative Kahn, there was no history and no clinical evidence of syphilis in four. The majority of those showing less than ++++ Kahn reactions had received various amounts of specific treatment.

Likewise, 98 consecutive patients coming to autopsy at the naval hospital, Washington, D. C., and on whom the records were sufficiently complete to warrant conclusions, it was observed that 77 (78.6 per cent) showed no clinical, serological, or pathological evidence of syphilis. The remaining 21 (21.4 per cent) all showed clinical, serological, or pathological evidence of syphilis, or were evidently syphilitic by all three methods. Only 3 of the 21 had negative Kahn reactions which could be explained by the com-

parative recency of the initial infections followed by specific treatment.

We believe that properly performed Kahn tests have a high degree of specificity and that even + and ++ reactions are of considerable significance. It must be borne in mind, however, that the laboratory technician is subject to error in more or less inverse proportion to his training. If there is any doubt concerning technique or any clinical reason which casts doubt upon the veracity of a test, we do not hesitate to repeat such tests until satisfied. We should beware of making a diagnosis of syphilis upon a *single* positive test of any degree in the absence of clinical evidence supporting such a diagnosis. Repeatedly positive tests, however, constitute good evidence of syphilis even in the absence of clinical support. Negative tests do not rule out syphilis completely. We have noted several cases with negative Kahns and Wassermanns who had evidence of syphilis at autopsy.

*False positive Kahn reactions.*—We have, however, occasionally observed apparently false positive reactions up to ++++. These were noted in mumps during the febrile period and disappeared during convalescence. The reactions were noted as peculiar at the time the test was performed in that they had a tendency to fade on standing after about one-half hour. Other naval officers have noted false reactions in mumps as well as in acute catarrhal fever, malaria, and in measles, the reactions becoming negative after the febrile period. It must be emphasized that these false positive reactions in febrile states are only occasionally seen in such conditions and are not the rule, by any means. We also recall a nonfebrile patient who persistently gave a ++ or +++ reaction without any other evidence of syphilis whatever.

*Reversible reactions.*—We have noted only an occasional reversible reaction. Other activities, however, find such reactions rather frequent, especially in treated cases.

*As a guide to treatment.*—It has been the experience of many of our clinicians that the Kahn is a better guide to treatment than is the Wassermann. The fact that the Kahn usually remains positive longer than does the Wassermann on a given case under treatment makes such an assumption apparent. The quantitative Kahn on strongly positive sera is not only easy to perform but gives the clinician a concrete guide by which to follow and judge the effects of treatment. We have frequently observed the Kahn to remain positive for several months after the Wassermann had become negative.

*The Kahn in emergencies.*—When selecting a new blood donor, or for any reason where haste is necessary in determining the presence or absence of syphilis, the Kahn is excellent because of the short time required for its completion and because of its reliability.

*Technical simplicity.*—Owing to the fewer reagents required and the simplicity of the Kahn technique, the Kahn test does not render itself liable to technical errors so readily as do the more complicated reactions. The Kahn, however, is not a test so simple that it may be relegated to untrained technicians. For the novice it is a harder test to read than the Wasserman, but such difficulties are overcome by practice. A technician can master the Kahn technique much more quickly than he can a complement fixation test for syphilis.

*Clinical data.*—We have recently reviewed certain available clinical and clinical-plus autopsy records to see if the number of units in a quantitative Kahn on blood serum has any relation to the clinical stage of syphilis or any bearing upon visceral involvement. In a study of 21 syphilitics coming to autopsy and of 93 clinical cases of syphilis giving + + + + Kahn reactions the following observations are noted for what they may be worth:

1. In primary syphilis the Kahn units varied from 4 to 80.
2. In the secondary stage the number of units was highest, varying from 4 to 1,400, with the highest number occurring early during the rash. In late secondary syphilis without clinical evidence of visceral involvement the units ranged from 4 to 80. It was also noted that the cases showing 1,400 units fell to 4 after one course of neosalvarsan.
3. In the series were 14 old cases of syphilis (7 to 43 years' duration) who had received little or no treatment and who presented no clinical evidence of visceral syphilis. The units here varied from 4 to 40.
4. There were also five old cases of syphilis with definite syphilitic lesions clinically, but without evidence of deep-seated, visceral involvement (central nervous system, brain, heart, etc.).

	Units
(a) Syphilitic optic atrophy.....	4
(b) Subcutaneous gummata.....	120
(c) Tertiary syphilitic ulcers.....	40
(d) Perforated nasal septum with hemorrhage and anemia.....	4
(e) Syphilitic osteomyelitis.....	40

5. Of more interest to us were those cases of syphilis showing clinical or autopsy evidence of visceral involvement:

(a) Untreated central nervous system lues ( paresis, tabes dorsalis, etc.), 11 cases. Ten showed 80 to 360 units and one 20 units.

(b) Treated central nervous system lues, 9 cases. Six showed 40 to 120; two, 4 to 20; and one, 240. There were still two other cases of syphilitic myelitis who had received considerable treatment. Here the blood Kahn was negative, and +, while the Wassermann was positive and strongly positive, respectively.

(c) Those cases showing involvement of the heart (aortitis, aortic insufficiency, aneurysm, with or without coronary disease) as the only evidence of visceral syphilis varied in units from 20 to 240, with the majority above 80 units. Some had received specific therapy.

(d) There were also four cases showing a combination of visceral syphilis, as central nervous system lues and syphilitic heart disease, or the latter with gummata of the liver, etc. The units here ran from 80 to 360.

(e) One case was apparently syphilis of the lungs clinically, with 280 units.

*Naval hospitals.*—Our naval hospitals perform the Kahn test routinely and usually on all admissions. The technique and general procedures are identical to those described for the Naval Medical School. For reasons given before, some of our larger hospitals also perform a modification of the Wassermann test. The antigen is obtained from the school, and sera for check tests are frequently submitted to the school. In Haiti, where there is a high percentage of syphilis among the general population, the Kahn is stated to be superior to the Noguchi.

*Hospital ship.*—The Kahn test as used on board a hospital ship differs in no wise from its use at the Naval Medical School except that the antigen is ordered from the school as needed and the quantitative Kahn is not performed routinely. While many other types of naval vessels use the Kahn test, it frequently happens during fleet concentration that these other ships refer their sera or patients to the hospital ship for the test. Because of this and also because of the fact that the test is done routinely on all admissions, the number of sera examined is large. Owing to the crowded conditions and a small though compact and well-equipped clinical laboratory on board a hospital ship, the Kahn test offers distinct advantages over the Wassermann in that it is simple, quick, reliable, and requires no laboratory animals.

*Other ships.*—The Kahn test is performed on many of our larger ships by a technician trained in the procedure, under the supervision of a medical officer. The antigen is ordered from the school as needed, and the procedure is usually limited to the standard test for blood and spinal fluid. This is a great advantage over former methods when it was necessary to send the patients' blood to a hospital ship or a naval hospital for such tests, and even this could not be done when the ships were at sea. A disadvantage is that in certain cases the medical officer may not be familiar with the Kahn technique and is thus incapable of supervising his technician. These ships, however, frequently have access to a shore station or a hospital ship where suspicious or doubtful tests may be repeated.

## CONCLUSIONS

In view of the Navy's six years' experience with the clinical application of the Kahn reaction, we feel that the following conclusions are justified:

1. The Kahn reaction is the best single serological test for syphilis.
2. The test is simple, quick, reliable, and thus peculiarly applicable under the various conditions of Navy life.
3. The Kahn is more sensitive and more specific than any complement fixation test which we have tried.
4. The Kahn gives fewer false positive reactions than any complement fixation test which we have tried.
5. The Kahn becomes positive earlier in syphilis and remains positive longer under treatment than any complement fixation test which we have tried.
6. False positives have been observed in isolated cases during the febrile states of mumps, measles, malaria, and acute catarrhal fever.
7. The Kahn test is excellent as a guide to specific therapy.
8. The Kahn test is not one to be relegated to untrained technicians.
9. Our observations suggest that the quantitative Kahn may be of value in the diagnosis of visceral syphilis. The observations at least suggest that, in old treated or untreated syphilis, a quantitative Kahn of 40 units or more should arouse suspicion of visceral syphilis. We do not mean to say that less than 40 units or even a negative test rules out visceral syphilis.
10. The Kahn reaction eliminates the so-called anticomplementary reaction so frequently seen in the Wassermann test. Thus certain sera may be suitable for the Kahn reaction when of no value for a Wassermann.

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"MILD INFLUENZA"

By J. BUCKLEY, Lieutenant Commander, Medical Corps, United States Navy, and A. R. BEHNKE, Lieutenant (Junior Grade), Medical Corps, United States Navy

This paper discusses 59 cases diagnosed acute catarrhal fever which occurred aboard the U. S. S. *Holland* and the submarines of Division 12. The malady began March, 1931, during the fleet concentration around Panama. It promptly subsided, and only a few scattered cases appeared until January, 1932, when a new outbreak arose.

The purpose of the article is to consider the diagnosis made in these cases and to attempt to differentiate cases of mild influenza from cases of catarrhal fever.

Of the 59 cases, 50 present characteristics so similar that a composite picture can be drawn which is a fair representation of any



individual case. The remaining nine cases were characterized by complications such as sinusitis, bronchitis, and pyelitis.

The 50 cases were featured by an onset, usually sudden, fever, chills, headache, varying degrees of prostration, and diffuse pains throughout the body which often localized in the back. Occasionally abdominal symptoms of pain, diarrhea, and respiratory symptoms of cough and nasal congestion presented themselves. The prominent symptoms, however, were fever and prostration, with headache and back pain as the usual concomitants. The common finding on physical examination was a hyperemia of the upper respiratory tract. Localization of infection in the sinuses, throat, and chest occurred, but in each instance was regarded as a complication and not as a part of the primary picture.

The most striking feature of the disease was the fever, which invariably was of one to two days' duration after the patient was placed in bed. Variations at the onset were between 99.5° and 104° F. The course was usually a gradual decrease by lysis, although an intermittent type of curve with a sudden drop to normal characterized some of the cases.

Prostration usually subsided with the fever, though in some cases it persisted for a week or more.

Another remarkable feature of the disease was the absence of severe complications. Nine cases showed complications such as bronchitis, sinusitis, and pyelitis, but these usually subsided within 10 days.

The pulse was usually elevated during the first two days. The white count usually remained normal, with a leucopenia in some cases and a leucocytosis in others, the average for the 50 uncomplicated cases being as follows: Leukocytes, 8,339; neutrophils, 63 per cent; lymphocytes, 35 per cent.

Treatment consisted of rest, forcing fluids, soft diet, and sedatives. Ephedrine sulphate administered in capsule form was invaluable in allaying symptoms, particularly the prostration.

The term "catarrhal fever" is very convenient. During periods of febrile outbreaks, with upper respiratory tract manifestations, it is a term that is applied not only to rhinitis and pharyngitis but also to sinusitis, tonsillitis, bronchitis, and influenza. The combination of *catarrh* and *fever* as a descriptive term can cover a multitude of ills.

For this reason we had a composite chart drawn of the temperature, pulse, and respiration from a number of similar febrile cases, and any variation from this chart made it incumbent upon the medical officer either to find the complication or to change the diagnosis. In this way a degree of "awareness" was developed during the endemic.

The question of diagnosis now arises. The term "catarrhal fever" was applied because it sounds relatively benign in comparison with influenza. Because of the short course of the disease and the absence of complications, there was no need of alarming Submarine Division 12 with the specter of 1918. However, it is felt that "mild influenza" is the most applicable term.

If we accept as influenza the clinical picture drawn by Soper (3) from observations of American soldiers in 1918, the relation of this malady to the present one is clear. Soper's picture is as follows: "The leading symptoms are: Severe headache; chills or chilliness; pains in the back and legs; temperature sometimes as high as 104° F.; great prostration and drowsiness. Occasionally there are nervous symptoms; sometimes, but not always, the eyes and the air passages of the nose and throat are affected; there may be gastrointestinal disturbances. The onset is sudden."

However, to differentiate influenza as presented in this paper from catarrhal fever (common cold) requires some care, but in the former the presence of fever, prostration, and the relative insignificance of catarrhal symptoms as parts of the primary picture are points serving to differentiate the two conditions.

The common cold is not usually characterized by fever or prostration, but may be said, Turner (6), to consist of headache; nasal obstruction, associated with profuse discharge which is at first watery and then later becomes mucopurulent. Inflammation may spread to the larynx or pharynx or the nasal condition may be secondary to an inflammation of these parts. The common cold is essentially a localized infection of the upper respiratory tract. Marked fever or prostration does not occur. Hence the term "catarrhal fever" to describe the common cold is misleading, since fever is not an essential part of the clinical picture.

Possibly the clearest difference in the two diseases is brought out by the experiments of Shibley et al. (4) and Long et al. (5) with chimpanzees. In inoculation experiments with these animals using filtrates from individuals suffering from common colds, there developed the following signs: "Injection of the conjunctivæ; profuse nasal discharge; mucopurulent postnasal discharge; frank inflammation of the nasopharynx, with swelling of the lymph follicles and continuous cough. The common symptoms were stuffiness of the nose, sore throat, and headache. *No fever was observed during the course of the attacks.* The duration of the colds was approximately one week."

Contrast these symptoms with those produced in chimpanzees with material inoculated from patients suffering from influenza. Three out of four animals developed fever, marked to moderate prostration and leucopenia. *None of these animals developed signs of focal re-*

*spiratory involvement.* Moreover, a further suggestive experimental fact differentiating the two conditions may be cited again from the work of Shibley et al. "During the course of this animal experimentation we have observed that the duration of immunity from colds has been from three to four months. During the epidemic of influenza in the early winter of 1929 the chimpanzees in the stock room contracted from one of the keepers a type of respiratory infection, characterized by pronounced constitutional and respiratory symptoms, which was quite unlike the common cold. This occurred well within the immune period and suggests that this influenzal infection was caused by an etiologic agent different from that of the common cold."

#### SUMMARY AND CONCLUSION

A series of 59 cases is discussed, 50 of them being best described by the term "mild influenza." Fever, prostration, and the usual absence of localized upper respiratory tract involvement serve to differentiate these cases from catarrhal fever (common cold).

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#### ONE-PIECE RESECTION OF THE THYROID GLAND

By J. J. A. McMULLIN, Commander, Marine Corps, United States Navy

Unsatisfactory results following thyroidectomy are due, in the majority of cases, to the removal of an insufficient amount of thyroid tissue. Myxedema following subtotal thyroidectomy is rare; tetany as a sequel to such operations is also rare.

Recurrence of hyperthyroidism following thyroidectomy is not rare. In this connection it should be emphasized that symptoms of hyperthyroidism recur following thyroidectomy even though all but a small amount of the gland substance is removed.

Realizing the importance of performing a resection as complete as may be consistent with the preservation of the function of the thyroid gland, the conservation of the parathyroid glands, and the avoidance

of injury to the recurrent laryngeal nerve, the following operation of resection of both lobes and the isthmus in one piece was devised.

*Technique of operation.*—The usual low-collar incision is made reflecting the skin, superficial fascia, and platysma myoides muscle upward to the level of the superior border of the thyroid cartilage. The usual vertical incision in the anatomical mid-line of the neck from the notch of the thyroid to the notch of the manubrium is made. A pair of dissecting scissors introduced through this incision separates the sternohyoid and the sternothyroid muscles on each side from the lobes of the thyroid. These muscles are clamped and secured near their insertion when the gland is large, and simply retracted when the gland is small.

The right lobe is delivered, and the superior and inferior thyroid vessels are clamped and cut between hemostatic forceps, the clamp on the inferior thyroid vessel including a small amount of the gland tissue. The right lobe is gently lifted from its bed, while its posterior capsule is separated from the areolar tissue by means of a wiping movement with a wet gauze sponge. This latter maneuver is effective in the preservation of the parathyroids. The blood supply of the left lobe is dealt with, and the lobe delivered in a similar manner. The right lobe is removed completely, except for a small amount of tissue in the sulcus between the trachea and esophagus. The dissection proceeds across the trachea, freeing the isthmus from its tracheal attachments. The blood supply of the left lobe is secured and the resection completed, leaving only a small portion of the posterior capsule and some glandular tissue in the tracheo-esophageal sulcus. In this manner both lobes and the thyroid isthmus are removed in one piece.

With this technique the most common cause of failure in thyroidectomy—the removal of an insufficient amount of thyroid tissue—is eliminated and the preservation of the parathyroids and recurrent laryngeal nerves assured.

This operation was performed, with unsupplemented local anesthesia, on 50 consecutive, unselected goiters during the past two years. This series of cases is not large, but sufficiently so to establish the feasibility and desirability of adopting a 1-piece resection of the thyroid gland as a routine procedure.

The accompanying photographs show the anterior and posterior view of an exophthalmic goiter recently removed by the technique described.

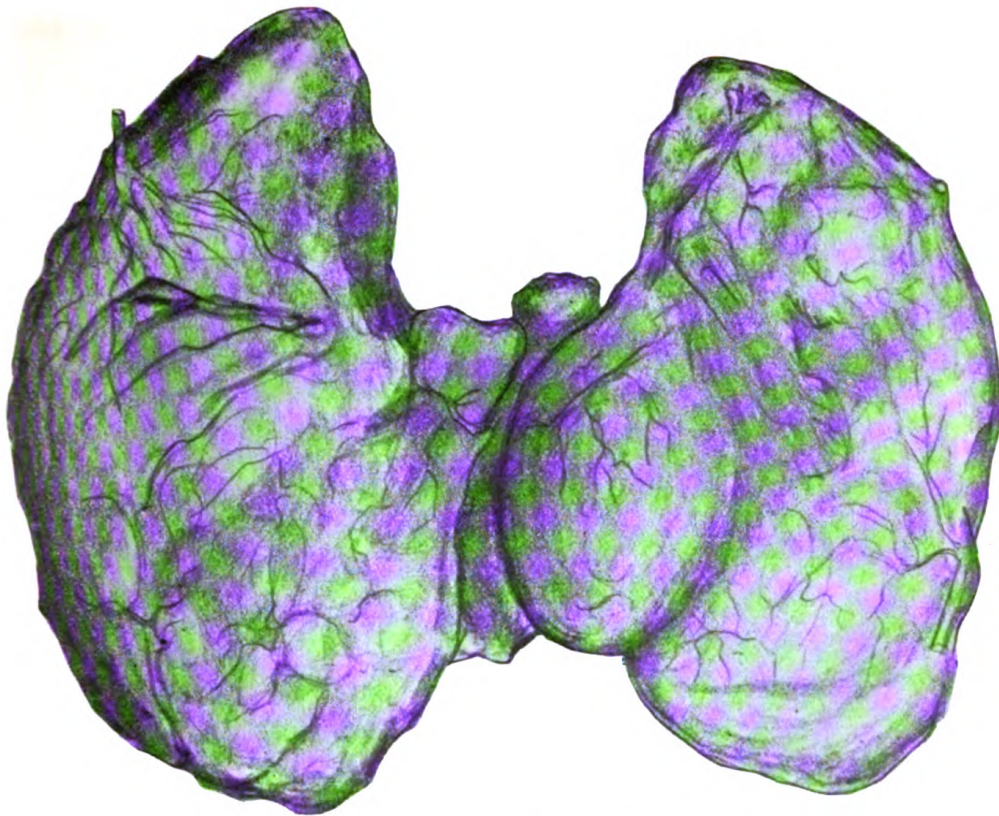


FIGURE 1.—EXOPHTHALMIC GOITER REMOVED BY 1-PIECE RESECTION  
Anterior view. (McMullin.)

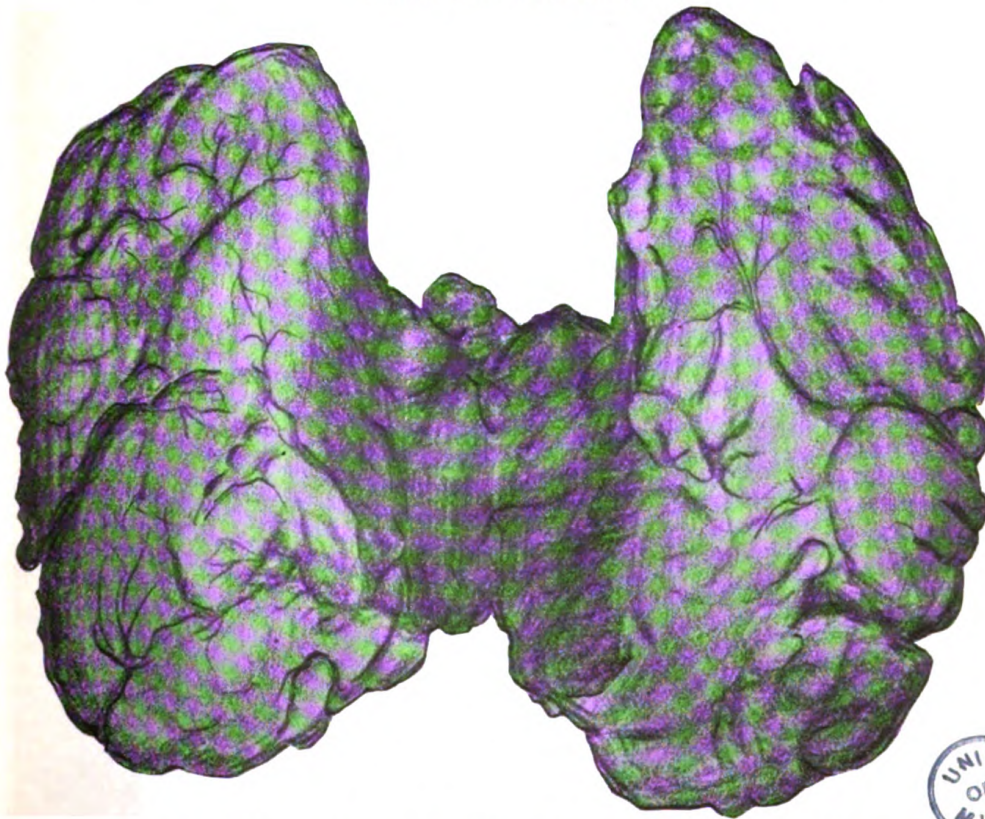


FIGURE 2.—EXOPHTHALMIC GOITER REMOVED BY 1-PIECE RESECTION  
Posterior view. (McMullin.)



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## CLINICAL NOTES

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### ROCKY MOUNTAIN SPOTTED FEVER (EASTERN TYPE)

#### REPORT OF CASE

By R. R. GASSER, Lieutenant Commander, Medical Corps, United States Navy

The United States Public Health Service in 1930, while making an epidemiological study of endemic typhus in the Eastern States, noted that many cases observed differed materially in clinical respects from the disease described by Price, Maxey, and others. It was noted that most of the cases living in rural districts or urban dwellers vacationing in the country suffered from a severe disease which did not correspond to the clinical picture of endemic typhus, and which resembled the spotted fever of the Rocky Mountains more closely than any other disease. Many of these cases gave a history of a tick bite within a short time preceding onset, and all cases gave a history of crushing engorged ticks removed from dogs or had had contacts in which a tick bite was possible.

These cases, resembling the spotted fever of the Rocky Mountains, corresponded quite well with the duration of the tick season and roughly with the relative prevalence of ticks. In the focal areas a systematic collection of ticks showed the predominant species to be *Dermacentor variabilis*. Occasionally specimens of *Amblyomma maculatum* and *Amblyomma americanum* were obtained.

The eastern type of Rocky Mountain spotted fever has been found in the rural communities of Delaware, Maryland, Pennsylvania, Virginia, North Carolina, and the District of Columbia.

The following case is of interest from several standpoints: First, diagnosis; second, the disease is not ordinarily expected to be found among service personnel; and, third, it is the earliest case in Maryland this year (onset March 26, 1932) to come to the attention of the National Institute of Health.

#### CASE REPORT

I, J. S., midshipman, age 22, was admitted to the United States naval hospital, Annapolis, Md., on March 28, 1932, along with two other midshipmen—all with a diagnosis gastroenteritis, acute.

*Chief complaint.*—Severe headache, backache, pain in joints and extremities, dizziness upon standing. Symptoms of two days' duration.

*Past history.*—Measles, mumps, and chicken pox. General good health at all times.

*Family history.*—Irrelevant.

*Present history.*—On March 25, 1932, he ate an oyster stew for lunch. About noon, March 26, 1932, patient felt chilly and soon had a severe headache, backache, pain in joints and extremities, and was dizzy when standing. The above symptoms continued well into the night, when he went to sleep. Upon awakening March 27, 1932, he felt fairly well. About noon symptoms, as of March 26, 1932, returned, but of a more severe character. Again upon awakening March 28, 1932, patient felt quite well, but reported at the sick bay because of symptoms of the two previous days.

*Progress notes.*—On admission to hospital March 28, 1932, patient had no particular complaints; felt generally well, denied having had any symptoms of acute gastroenteritis, but felt that his symptoms were probably due to the oysters he had eaten on March 25, 1932. Temperature, 100.4° F.; pulse, 104; respirations, normal. Physical examination was negative, except for injection of pharynx and coated tongue.

He was put to bed, placed on liquid diet, and given a purgative.

About noon he complained of severe occipital headache, which rapidly became generalized—backache, pain in joints and extremities. He had a severe chill, and fever rapidly developed. At 3 p. m. temperature was 103.2° F. Later in afternoon he had another chill. All aches and pain were of a severe character and continued well into the night. At 2 a. m. (March 29, 1932) he vomited and then felt better and went to sleep.

March 29, 1932: At 7 a. m. temperature was 100.4° F. Patient felt quite well; had no particular complaints. On both wrists, forearms, palms of hands, ankles, lower legs, and soles of feet was noted a discrete, macular, roseolar eruption that did not itch and which disappeared on pressure.

With the development of the rash the true diagnosis became a question. Many conditions in which eruptions develop were considered, but lack of physical signs ruled out one after another. By the middle of the morning the same symptoms as of the previous days developed, but more severe in character. Chill and fever at 11 a. m. was 103° F. with the advent of fever, rash rapidly spread over arms, thighs, and back. Early in the afternoon he complained of severe pain in the right shoulder and had moderate dyspnea. Discomfort was somewhat controlled with phenacetin and aspirin. About 8 p. m. he had a second chill, with all symptoms more severe. Phenacetin and aspirin were repeated. Headache and general body pains continued until about 3 a. m., when patient went to sleep.

March 30, 1932: At 7 a. m. temperature was 98.8° F. Patient felt fairly well. Rash now has become very pronounced, very vivid, covering hands, arms, feet, legs, thighs, and back. Abdomen and chest showed only a few scattered spots. Back was sore and the right wrist, both knees, and both ankles were tender on pressure. Again, about noon headache, general pains and aches developed. Chill and fever at 3 p. m. of 103° F. With the high temperature, rash became more pronounced and vivid. Aches and pains continued late into the night, phenacetin and aspirin being repeated before getting to sleep.

With the daily repetition of symptoms and practically no physical sign except the rash, Rocky Mountain spotted fever was considered. Patient was quite certain he had had no insect bites nor had he been any place where contact with insects might have been probable.

March 31, 1932: At 7 a. m. temperature was 100° F. Rash on arms less vivid, though on legs and back it is still of a vivid hue, but entire rash appears to be



taking on a hemorrhagic character. Joints continue sore on pressure. About 1 p. m. he had an indistinct chill, followed by fever at 3 p. m. of 102.2° F. Headache and generalized aches and pains as on previous days but less severe in character. Rash more pronounced during height of fever. Phenacetin and aspirin required once. The patient was questioned again concerning the possibility of contact with insects, and he recalled having played golf on the afternoons of March 16 and again on March 20, 1932. He was not conscious of having been bitten on either date, but during the evening of March 20, 1932, he noted itching on outer surface of the right ankle and scratched this area until going to sleep. Closer examination of this area showed evidence of a bite or an area which, due to scratching, had been denuded of the epithellum.

April 1, 1932: At 7 a. m. temperature was 99.4° F. Patient had a very good night and slept fairly well. Headache and general body aches and pains were less severe and of shorter duration. He perspired freely during the night. Right wrist and right elbow continue slightly tender on pressure. Knees and ankles are weak and sore when standing. Rash has lost its vivid hue except for a few consolidated areas on the back. On legs, feet, arms, and hands rash is much fainter and of a purplish-brown hue. Rash on legs and arms is made more prominent and of a deeper purplish hue when parts are put in the dependent position for a few minutes. About noon patient had a slight chill (chilly sensation), with fever of 101° F. at 1 p. m. Headache and general body aches and pains much less severe. Rash more prominent during height of fever and patient complained of a sense of constriction in throat. Symptoms and fever continued into the early night. No medication was necessary.

April 2, 1932: Patient had a good night, and had no complaints; 7 a. m., temperature 98.6° F. Rash is now an indistinct brownish hue, made more prominent when extremities are in dependent position. No joint soreness.

About noon developed chilly sensation with very gradual rise of temperature until at 7 p. m.—100° F.—accompanied with slight headache and general body pains and aches. Rash more prominent during febrile period.

April 3, 1932: Patient had a good night; 7 a. m., temperature 98.6° F. Rash is very indistinct on arms, thighs, and back; in palms of hands, wrists, and lower legs is still quite noticeable and of a deep brownish color. With extremities in dependent position rash becomes prominent and a purplish-brown color. Temperature remained normal all day. No symptoms.

April 4, 1932: Patient had a good night. Temperature normal. No symptoms. Rash only slightly noticeable, except when extremities are in dependent position.

April 8, 1932: Temperature has remained normal. No symptoms. Rash very indistinct on extremities, except when parts are in dependent position, when a purplish-brown discoloration develops. Discharged to duty under observation.

*Laboratory findings.*—At no time did the leukocyte count exceed 7,500. Differential count: Polys, 81 per cent; lymphs, 18 per cent; eosinophiles, 1 per cent. Urine showed a faint trace of albumin, with a few finely granular casts only twice. Felix-Weil agglutination: Blood taken on eighth day of sickness—complete agglutination of *B. proteus* X 19 in dilution of 1 to 40. Partial agglutination in dilution of 1 to 80.

Blood taken on fifteenth day of sickness—agglutination same as on eighth day.

Blood taken on twenty-second day of sickness—complete agglutination in dilution of 1 to 80. When examined on the fifteenth day and the twenty-second day the rash was still prominent on the lower legs and wrists when these parts were in the dependent position.

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**MALIGNANT TUMOR OF TESTICLE WITH POSITIVE ASCHHEIM-ZONDEK REACTION (FRIEDMAN MODIFICATION)**

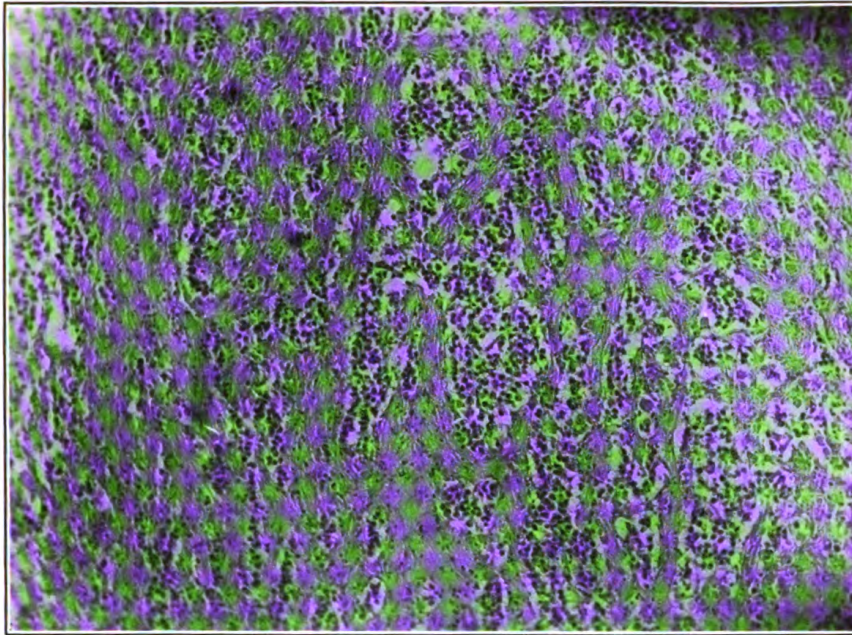
## REPORT OF CASE

By LUCIUS W. JOHNSON, Captain, Medical Corps, United States Navy, and W. W. HALL, Lieutenant Commander, Medical Corps, United States Navy

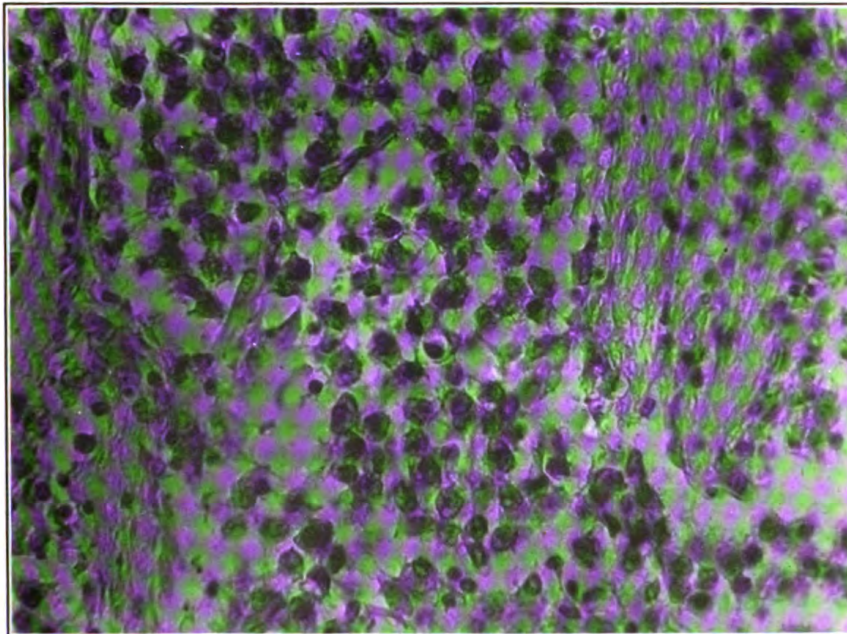
In the Practical Medicine Series yearbook on obstetrics and gynecology for 1930, there are several pages given to a consideration of the status of the Aschheim-Zondek test. The statement is made that, in addition to pregnancy, chorionepithelioma also gives a positive reaction, and there follows this query, "Has anyone tested a case of so-called chorionepithelioma of the testicle?—Ed." Heidrick et al. (1) later reported a positive Aschheim-Zondek reaction in a case of malignant embryoma, chorionepithelioma type, in a 35-year-old man.

Lieutenant Commanders Hall and McMorries, of the San Diego Naval Hospital, have been engaged for many months in the study of the Friedman modification of the Aschheim-Zondek test in pregnant women and have become conversant with the literature on the subject and expert in its performance. So we are able to present a case of embryonal malignant tumor of the testicle in which the test was undoubtedly positive.

Ferguson et al. (2) present an elaborate study of this test as a means of differentiating testicular tumors. They found positive reactions in all cases of teratoma testis examined by them where either the primary growth or any resulting metastasis remained clinically active. They state: "The earliest known positive reaction after onset of the teratoma was obtained three months after the first symptom. If this phenomenon can be verified by further investigation and by others, it would appear that we have at hand a biological means of remarkable consistency for the detection of the malignant tumors of the testis at an early date in the course of the disease. Our results also indicate the consistent absence of the hormone in nonmalignant disease of the testis. The reaction disappears rapidly after effective treatment and affords a means for the verification of the actual clinical control of teratoma testis."



**FIGURE 1.—MALIGNANT TUMOR OF TESTICLE**  
 Low-power view showing fibrous stroma and nests of cells. (Johnson and Hall.)



**FIGURE 2.—MALIGNANT TUMOR OF TESTICLE**  
 High-power view showing nests of embryonal type cells. Mitotic figure in center. (Johnson and Hall.)



The importance of a means of early diagnosis of malignant tumors of the testicle is indicated by their statement: "Dean recently pointed out that the correct diagnosis is so rarely made that only 11 per cent of 124 cases were free of local recurrence or metastasis on admission to the Memorial Hospital. Yet 43 per cent of this group consulted physicians within a month of the first noticeable symptom. Any method, therefore, which will reliably promote earlier and more accurate diagnosis of the teratomata should prove of great value to the patient and of more than passing interest to the physician." Their results lead them to believe that the test is probably positive in most of the malignant tumors of the testicle and not alone in chorionepithelioma.

Our patient had an undescended testicle, located within the peritoneum. It was removed, and while the test was not made until after the removal, it correctly indicated the nature of the growth. The fact that the test became negative 11 days after the tumor was removed indicates that there are no active metastases or local extensions. The test will be repeated from time to time in checking the subsequent postoperative course.

Two other cases of embryonal malignant tumor (seminoma) in which the test was not done before operation have, after removal and radiation, in this hospital, given negative reactions, from which we infer that operation and radiation have controlled both extensions and metastases.

The specificity of the Aschheim-Zondek test and of Friedman's modification (in which female rabbits are used) depend upon the production during pregnancy of an enormous increase of anterior pituitary hormone. This hormone, produced under the stimulation of the products of conception (embryonal tissue), designated "Prolan A" by Aschheim and Zondek, apparently acts as a motor of sexual activity. It is excreted in the urine of pregnant women and when injected produces ovulation in the female rabbit and mouse. Malignant embryonal tumors of the testis producing a positive Aschheim-Zondek or Friedman reaction act in a fashion analogous to normal embryonic tissue in normal pregnancy or to hydatidiform mole or chorionepithelioma in the female.

Varieties of teratoma testis are given by Ewing (3) as—

- (1) Adult embryomas or teratomas.
- (2) Embryoid, teratoid, or mixed tumors.
- (3) Embryonal malignant tumors. Under this heading he describes seminoma (sarcoma testis) and chorioma.
- (4) Miscellaneous tumors of the testis, tunica, and cord (fibroma, chondroma, myoma, sarcoma, interstitial cells, adrenal tumors of testis).

With reference to metastases of teratoma testis, he says: "Nearly all varieties of the embryonal and mixed tumors may prove malignant and give rise to metastases."

#### CASE REPORT

A man, age 41, was admitted to the hospital with varicose veins. In the course of his general physical examination a tumor of the abdomen was discovered. He said that he had been conscious of the mass for a couple of years, but thought nothing of it because he could feel it only when his bladder was full.

The tumor was apparently the size of an orange, and found usually in the lower left quadrant. It was freely movable and could be easily displaced to any part of the left side of the abdomen. Since there was no testicle in the left side of the scrotum, we concluded, correctly, that it was his left testicle, swinging on a long pedicle.

Operation was done under spinal anesthesia through a low left rectus incision. The tumor was found deep in the pelvis. It was a hard, lobulated mass on a thin pedicle about 5 inches long which consisted of the spermatic vessels and the vas, surrounded by peritoneum. The pedicle was served at its base and the tumor removed.

*Pathological examination of tumor.*—Gross; a firm lobulated tumor, 12 by 8 by 6 cm, covered by peritoneum. On section it is seen to be divided into lobules by fibrous septa. The contents of these lobules vary somewhat in consistency and vascularity.

*Microscopical examination.*—There is considerable stroma which varies somewhat in density and in size and number of nuclei. The fibrous tissue divides the tumor into gross lobules; it also is present abundantly throughout the masses. Large round cells of embryonal type lie in nests surrounded by the irregular fibrous septa. Mitotic figures are fairly frequent. Strands of lymphocytes are occasionally seen. The abundant connective tissue intimately mixed through the tumor was at first thought to be teratomatous differentiation. It is believed, however, that it should be interpreted as a type of tissue defense reaction and that the tumor should be classified as embryonal carcinoma (sarcoma testis, seminoma).

#### COMMENT

It is believed that this test should prove a valuable aid in differential diagnosis of testicular tumors or in the detection of metastatic growths and should be used routinely in such cases.

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## COCCIDIOIDAL GRANULOMA

## REPORT OF CASE

By R. G. DAVIS, Commander, Medical Corps, United States Navy

Coccidioidal granuloma has been considered a disease of great rarity, particularly in the naval service. Some 200 cases have been reported in the literature, with California accounting for slightly over 80 per cent, and making it a reportable disease in that State since 1928. The first case was reported from Buenos Aires in 1892, with the second and third cases from California in 1894.

In lesions of the lungs, bones, and soft tissues, closely resembling blastomycosis and tuberculosis, a specific fungus was found resembling the protozoan parasite coccidium and mistaken as such. Later, inoculation and cultivation revealed its fungus nature, reproducing by endosporulation instead of budding, and it was given the name of *Coccidioides immitis*.

On artificial media the fungus grows as a mold, while in tissue, pus, and sputum it appears as a highly refractile, doubly-contoured capsule, varying from 5 to 50 microns in size. As the cell increases the protoplasm gradually becomes separated into a large number of small round cells, each developing its own cell wall, thus forming spores. At maturity the mother cell and the large number of small cells are liberated into the tissues, gradually increasing in size and passing through the same process. The enormous redistribution of cells through endosporulation probably accounts for the high degree of malignancy. The early idea of nearly 100 per cent mortality has been modified as more cases are reported and early laboratory tests applied. Animal inoculations are more successful than with blastomycosis, the rabbit and guinea pig being most susceptible. The disease has been found in slaughtered sheep and cattle involving the bronchial and mediastinal lymph nodes, submaxillary glands, lungs, and liver. The high percentage of positive findings in cattle and sheep indicates infection of human beings and certain animals in California is not unusual. The disease probably occurs oftener than formerly suspected. It may be primary in the lungs or skin, but pulmonary cases are the most frequent and may be primary to cutaneous lesions. The cutaneous type resembles blastomycosis, with the pulmonary type bearing a striking resemblance to tuberculosis. The primary infection tends to attack the basal lobes and is not apical as in tuberculosis. It is more acute than blastomycosis, with higher fever and a greater tendency to be disseminated by the blood stream. The mode of onset of coccidioidal granuloma, early clinical course, and pathology closely follow that of tuberculosis. Lymph nodes, skin, abdominal and thoracic viscera, meninges, bones, and joints



may be involved and only differentiated by the histological examination of the tissues or bacteriological studies of the local discharges.

The portal of entry of the *Coccidioides immitis* may be through the skin, as several cases are reported following abrasions, but probably the greater number of infections is through the respiratory tract, through inhalation of fungus spores. The highest incidence of the disease has been found in regions of prolonged, hot, dry summer weather. Superficial skin lesions are not uncommon during the course of a generalized infection, or they may occur as the initial lesion. They are verrucous in character and may persist for months or years before generalized infection occurs. Large subcutaneous abscesses are often painless, with no discoloration, and may develop without the knowledge of the patient. They may connect directly with adjacent or distant lesions of bones, and if in the chest wall resemble tuberculosis of the ribs. Soft tissue lesions may be present with no connection with bone lesions. These should be aspirated for diagnosis, as an incision shows little tendency to heal. Bone lesions are common late in the disease, located in the cranium, ribs, sternum, pelvis, vertebræ, also the large and small bones of the extremities. Large quantities of pus may be present with little or no pain. Meningitis is not uncommon later in the course of a generalized infection, but may occur as the primary sign. The case here reported is probably secondary to a primary lung infection, as the early history points to a "miliary tuberculosis." The spinal fluid suggested tubercular involvement of the meninges, and the autopsy was so recorded until microscopical examination revealed the true nature of the disease. Cases are on record of supposed healed tubercular lesions in lungs proving at autopsy to be incapsulated foci of coccidioidal infection. The fever course is not diagnostic. The red blood cells and hemoglobin may be normal. Leucocytes may be normal or increased. Agglutination and complement fixation tests are not of practical diagnostic value. Blood cultures may be positive, but only late in the disease; hence the only reliable diagnostic procedure is the demonstrating of the typical spherical sporulating or nonsporulating bodies in the tissues, pus, or sputum and the growth of the fungus on artificial media. The prognosis is always grave but not hopeless. Treatment consists largely in general support of the patient as in tuberculosis. If lesions are confined to an extremity and no evidence of infection elsewhere, amputation or joint excision may terminate the disease. X rays may aid superficial lesions, but are of little if any value in deep-seated ones; vaccines are doubtful; iodides, salvarsan, and other arsenicals not proven. Colloidal copper in the muscles and 1 per cent antimony potassium tartrate intravenously have given the best results.



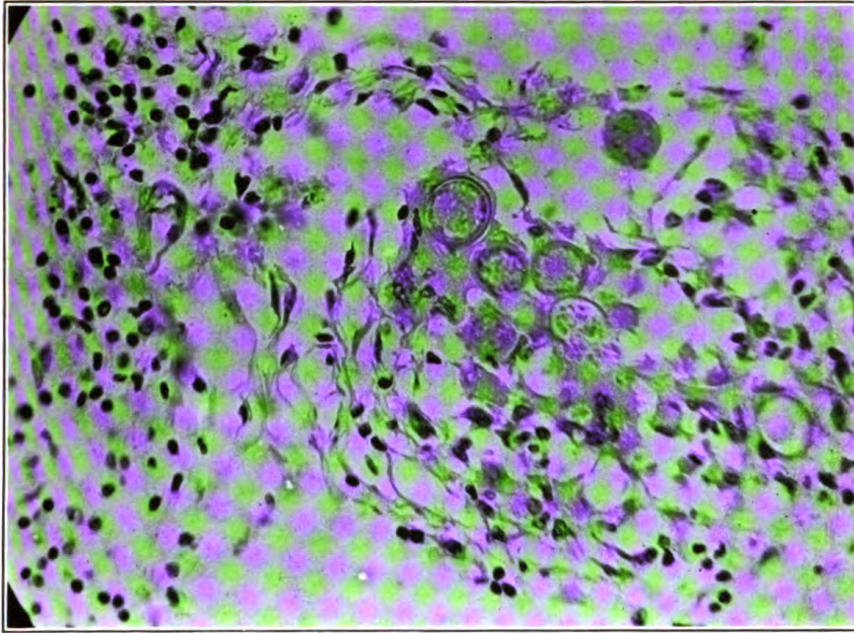


FIGURE 1.—COCCIDIOIDAL MENINGITIS SHOWING THE CHRONIC GRANULOMATOUS TYPE OF TISSUE REACTION

There are a number of mature organisms present in this field which show endospores and a doubly contoured membrane. The capsule of one has ruptured and the spores are seen escaping into the tissues. (Davis.)

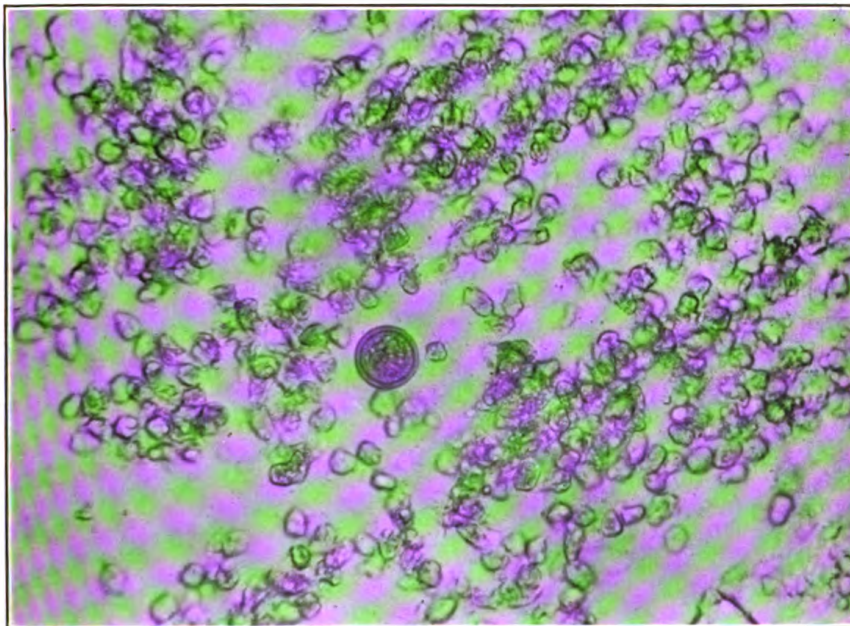


FIGURE 2.—COCCIDIOIDES IMMITIS IN FRESH IODINE PREPARATION

Exudate from subcutaneous abscess in experimental animal. The organism lies surrounded by pus cells, shows endospores and a refractile doubly contoured membrane. (Davis.)





## CASE REPORT

G. W. D. age 39, Veterans' Bureau patient, resident of Santa Ana, Calif., was admitted to the San Diego Naval Hospital, September 25, 1931, with the tentative diagnosis of miliary tuberculosis. His chief complaint was loss of weight and strength, with failing memory, accompanied by periods of disorientation.

*Family history.*—Negative, except that one brother died three years previously of tuberculosis.

*Past history.*—Typhoid at 3 years of age and pneumonia at 10.

*Course of disease.*—The essential physical conditions were an undernourished appearance, palor, slow in speech, and confused memory. Head and neck negative. Abdomen and genitalia negative. Extremities negative. Soon after entry to the hospital patient became disorientated, restless, and exhibited a childish jocularity. The tentative diagnosis of miliary tuberculosis could not be confirmed by physical or radiographic studies of the chest, abdomen, kidneys, or ureters, nor from cystoscopic examination and search for acid-fast bacilli in the urine. Agglutination tests for typhoid, paratyphoid, undulant fever, and tularemia were negative. A history of the illness preceding the mental disturbance was obtained from a nurse friend of the family. The illness began acutely in August, 1931, with fever ranging as high as 102° F. for about two weeks. He was admitted to a local hospital, but went home after two weeks' treatment. A definite diagnosis was not made, but typhoid and undulant fever were considered. Temperature went up irregularly to 101° F., and mental state appeared normal until shortly before admission to this hospital. General picture, one of psychosis with infectious disease.

November 2, 1931: Control of sphincters lost. Spinal fluid: Kahn, negative; cells, 6 lymphocytic in type; dextrose, 90; globulin, positive; culture, negative; gold curve, 000125554; color, yellow, but no coagulation on standing.

November 4, 1931: Eye grounds negative.

November 6, 1931: X-ray skull negative; clinoids thin.

November 9, 1931: Spinal fluid: Color, yellow; flow, free; Kahn, negative; cells, 70; globulin, positive; dextrose, 71; gold, 5555555555.

December 16, 1931: Nerve heads show mild neuritis.

December 20, 1931: First complaint of headache. Plantar extension left great toe.

January 5, 1932: Lumbar tap only 1 cc of yellow fluid could be obtained.

January 5, 1932: Vomiting first noted.

February 10, 1932: Condition of patient became steadily worse.

Decubitus extensive. Quite noisy in the ward.

Patient continued growing weaker, presenting clinical picture of chronic meningitis, and died February 23, 1932.

*Autopsy report*

The body was that of an emaciated white male, apparent age 40 years. It had been embalmed. Areas of decubitus were noted on the buttocks and heels. Permission had been granted to examine the brain only.

*Head.*—There was some increase above normal in the amount of cerebrospinal fluid. The fluid was slightly blood tinged. Around the brain stem, involving the entire medulla and pons, were evidences of a chronic inflammatory process which had involved the pia-arachnoid and part of the brain substance. There was a slight amount of fibrous tissue replacement in this area. The remainder of the brain appeared normal.

*Gross pathological diagnosis.*—Meningitis, chronic (probably tuberculous) basilar.

*Histopathological diagnosis.*—Microscopical examination revealed a chronic granulomatous process with many giant cells and numerous doubly contoured bodies, small and large, showing endospores, *Coccidioides immitis*.

#### COMMENT

It was unfortunate that only the brain examination was permitted. Skin and bone lesions were absent, and the degree, if any, of involvement of internal organs could not be determined. It is possible that the lungs were early involved, as a tentative diagnosis of miliary tuberculosis had been made prior to admission. The meninges centered the infection throughout the course of the disease, giving the clinical picture of an infective psychosis or chronic meningitis. Autopsy and microscopical sections established the diagnosis.

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### INTESTINAL OBSTRUCTION, PARALYTIC

#### REPORT OF CASE

By O. A. SMITH, Lieutenant, Medical Corps, United States Navy

The following case of postoperative ileus is submitted, not with a view toward contributing anything new on the treatment or the subject of paralytic ileus, but because it is believed to be a graphic illustration of the value of starvation, gastric lavage, and the maintenance of the body fluids in the therapy of this condition.

#### CASE REPORT

E. B., white, age 42, Veterans' Bureau patient, was admitted to the United States naval hospital, Great Lakes, Ill., on September 22, 1931, for treatment of a right inguinal hernia of 14 years' duration. Physical examination showed

an indirect, right inguinal hernia, diseased tonsils, and marked pyorrhea. Blood Kahn negative and urine normal. Weight, 160 pounds; height, 6 feet 4 inches.

*Progress notes.*—September 24: Hernia repaired under local and regional block anesthesia and cord transplanted. A long retrocecal appendix was removed through the hernial sac.

September 26: During the second night patient had some nausea and vomiting and developed persistent hiccoughs; marked relief from gastric lavage; wound in good condition; abdomen slightly distended; 4,000 cc 5 per cent glucose by hypodermoclysis; water in small amounts by mouth. Temperature, 99; pulse, 110; respiration, 25. White blood count (see chart).

September 27: Hiccoughs and tendency to vomiting continue. Abdominal distention has increased. Turpentine stupes and rectal tube afford no relief. Soapsuds enema and 1 cc pituitary extract cause some gas to be expelled. Vomitus consists mostly of bile and duodenal contents; 6,000 cc 5 per cent glucose by hypodermoclysis; nothing by mouth. Temperature, 99; pulse, 110; respiration, 25. White blood count (see chart). Urinalysis showed trace of albumin and many finely granular casts.

September 28: General condition much worse. Gastric lavage affords only brief relief from hiccoughs and vomiting. Abdomen greatly distended. Pulse thready and irregular. Rehbus tube inserted and left in place. About 200 cc of clear, dark-green material obtained by aspiration every half hour; 500 cc 2 per cent NaCl in 10 per cent glucose solution given slowly by vein; 6,000 cc 5 per cent glucose by vein. Temperature, 99; pulse, 110; respiration, 20. White blood count (see chart). Blood chemistry taken before above fluids were administered: Urea nitrogen, 75 mg per 100 cc; sugar, 125; creatinine, 2.3; nonprotein nitrogen, 150; chlorides, 363.

September 29: Rehbus tube removed after having been in place 24 hours, and patient is no longer vomiting or hiccoughing. He is still greatly distended and there is a definite tender area midway between the operative scar and umbilicus. This area is not acutely tender and no mass palpable. Patient was given eserine gr  $\frac{1}{60}$  and pituitrin minims 5 every two hours for four doses, then placed in the knee-chest position and given a large, high soapsuds enema. Following this he passed a great deal of gas and some formed stools; 6,000 cc 5 per cent glucose by hypodermoclysis. Temperature, 99.5; pulse, 95; respiration, 20. White blood count (see chart).

September 30: Seems slightly improved. Two small bowel movements early this morning. Less abdominal distension present. Enema as yesterday repeated, with about the same results; 4,000 cc 5 per cent glucose by hypodermoclysis, one-half ounce of water by mouth every half hour. This is the first fluid he has had by mouth for four days. Rehbus tube reinserted. Lavage through this tube every two hours. Temperature, 100.5; pulse, 90; respiration, 20. White blood count (see chart). Hemaglobin, 45 per cent (Dare).

October 1: Two gastric lavages necessary during the night for relief of vomiting. Very uncomfortable, and complains of pain extending from operative site to umbilicus. Fecal odor to gastric contents. Hemaglobin, 55 per cent (Dare); red blood count, 3,100,000; 620 c c whole blood transfused by direct method; 1,800 c c 5 per cent glucose by hypodermoclysis. Temperature, 99.5; pulse, 90; respiration, 20. White blood count (see chart).

October 2: Had a restful night. Small bowel movement early this morning. Less fluid obtained from stomach through Rehbus tube. Less distention, rigidity, and tenderness of abdomen. Has a marked left orchitis; also a moderate rectal prolapse which is reduced without difficulty. Water as desired;



2,000 c c 5 per cent glucose by hypodermoclysis. Temperature, 100; pulse, 90; respiration, 20; red blood count, 4,410,000. Hemaglobin, 80 per cent (Dare). White blood count (see chart).

October 3: Allowed milk, 1 ounce every half hour. This is the first nourishment he has had by mouth for eight days. Having watery bowel movements. He has considerable pain from the left orchitis and some edema of the scrotum. Temperature, 101; pulse, 90; respiration, 20. White blood count (see chart).

October 4: Abdomen soft. Eating milk toast. Has a mild diarrhea.

October 5: Continues to improve, except for orchitis. White blood count (see chart).

October 6: Blood chemistry: Urea nitrogen, 11 mg per 100 c c; sugar, 78; creatinine, 1.5; chlorides, 429. White blood count (see chart).

October 8: Diarrhea decreasing. Under local anesthesia, incision made in left side of scrotum down and into testicle and about 1 ounce of pus evacuated.

October 11: Up in a wheel chair. Takes semisoft diet well.

October 13: Weight, 147 pounds, a loss of 13 pounds since admission.

October 15: Red blood count, 4,600,000; hemaglobin, 85 per cent (Dare); white blood count (see chart). Urinalysis normal.

October 17: On regular diet.

October 30: Discharged to home; well.

*Chart showing white blood count, differential, fluid intake other than by mouth, and diet*

	September					October					
	26	27	28	29	30	1	2	3	5	6	15
Juveniles.....		3	3	6	8	5	2	2	3		
Band forms.....	35	53	45	42	57	48	40	43	56	18	16
Segmented.....	48	15	29	7	3	11	37	28	31	37	59
Eosinophiles.....				2		2	2	5		3	1
Basophiles.....		1									2
Mononuclears.....	2	10	2	6	7	7	5	1	3	6	7
Lymphoblasts.....				33							15
Lymphocytes.....	15	17	19		23	27	14	21	7	36	
Reticulocytes.....		1									
Unclassified.....			2		2						
Total white blood count	11,860	6,450	5,600	4,860	6,480	8,500	6,800	5,800	14,700	7,360	7,980
Fluid intake other than by mouth, in cc <sup>1</sup> .....	4,000	5,000	6,500	4,300	4,000	2,420	2,000				
Diet.....	(2)	(3)	(3)	(3)	(3)	(4)	(4)	(5)	(5)	(6)	(7)

<sup>1</sup> Total, 28,220 cc.

<sup>2</sup> Sept. 26, water.

<sup>3</sup> Sept. 27, 28, 29, and 30, nothing.

<sup>4</sup> Oct. 1 and 2, water.

<sup>5</sup> Oct. 3 and 5, milk.

<sup>6</sup> Oct. 6, soft diet.

<sup>7</sup> Oct. 15, regular diet.

#### COMMENT

It is believed that in the case under discussion the ileus was due both to reflex and inflammatory causes, the latter due to trauma, although at the time of the operation no special difficulty was encountered in repairing the hernia nor in removing the appendix. Fibrinous adhesions apparently developed around the cecum, causing at least a partial obstruction and localized peritonitis concurrent with the paralysis. This is borne out by the patient's persistent complaint of pain and tenderness in this region, though probably due to the marked abdominal distension, no mass could be felt.

The suppurative orchitis was due to an infection following repeated hypodermoclysis in the inner part of the thighs. The anemia was due to starvation, and the beneficial results of a transfusion were at once apparent. The "shift to the left" is of interest. As the patient became more critically ill and as the condition progressed, the total white blood count became less and a higher percentage of immature cells were thrown into the circulation.

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### SYRINGOMYELIA

#### REPORT OF TWO CASES

By J. J. WELLS, Lieutenant (Junior Grade), Medical Corps, United States Navy

Atrophy of the muscles of the hand and forearm occurs in a number of neurological diseases, of which the most common is syringomyelia. The claw hand, or "main en griffe," though not pathognomonic of syringomyelia, often characterizes the disease in its earliest stage because of the predilection of the process to begin at that segment of the spinal cord which innervates the muscles of the hand and forearm. On account of the protean symptomatology of the disease it is frequently confused with a number of other neurological and traumatic conditions.

Although more cases of syringomyelia are being reported from the various clinics throughout Europe and America than previously, it is still a rare condition. During the past year, for instance, on the neuropsychiatric service of the United States naval hospital, Chelsea, Mass., with an average admission rate of 75 patients per month, there have been diagnosed only two cases of this disease.

Because of its comparative rarity in the Navy, the following cases are reported:

#### CASE REPORTS

*Case 1.*—C. E. S., a 44-year-old druggist, was admitted to the hospital complaining of an inability to straighten out the fingers of his right hand. There was an associated weakness and trembling of the whole right arm and a weakness and trembling of the left hand.

*History.*—The patient stated that ever since his discharge from the Army in 1918 he has noticed the weakness and tremor of his right hand and arm.

*Laboratory examinations.*—Negative.

*Physical examination.*—A fairly well developed and nourished male. Buried and atrophic tonsils; false upper and lower teeth; right lower appendectomy scar. There is a drooping of the right shoulder, with atrophy and flaccidness of the trapezius, deltoid and pectoral muscles. The muscles of the right arm, forearm, and hand are weak, flaccid, and atrophied, without any evident fibrillary twitchings. The right hand assumes the position of a "main en griffe." There is atrophy of the thenar, hypothenar eminences, and the dorsal interossei muscles. The left hand shows a similar process, but to a lesser

degree. There is a right dorsal left lumbar scoliosis; hallux valgus of the right foot, with atrophy of the interossei muscles. There is some weakness of the muscles of the right calf and thigh.

Neurological examination reveals a total diminution of the sense of pain by pin prick from the vertex of the skull to the sole of the foot on the right side, the pin prick being felt as dull. There is a right-sided loss of discrimination between hot and cold. The sense of position is slightly diminished on the right side. Tactile and vibratory senses are normal. The tendon reflexes of the right arm are diminished but present. Dorsiflexion of the right wrist is weakly performed. Thumb-to-finger test can not be done. The patient can not extend, abduct, or adduct the fingers of the right hand. The knee jerks and ankle jerks are bilaterally hyperactive. Ankle clonus and Babinski are absent. The superficial reflexes are equal and active. There is a coarse tremor of both hands and arms. Finger-to-nose test poorly performed. Romberg equivocal. There is a hypalgesia of the right side of the face. No weakness of the facial muscles. Speech tests performed normally.

*Case 2.*—P. F. B., a 42-year-old cook, was admitted to the hospital complaining of weakness of the fingers and hands.

*History.*—In 1929, following an injury to his right thumb (a 10-pound drill struck his right thumb and injured the first interphalangeal joint), the patient began to notice a numbing and tingling sensation in his right hand. This gradually became worse and at times very painful. There was a gradually increasing weakness of the muscles of the hand. In 1930 his left hand began to be similarly affected.

*Laboratory examinations.*—Negative.

*Physical examination.*—A well nourished and developed male. Patchy areas of psoriasis on the extensor surface of the elbows, legs, and scalp. Atrophy of the muscles of the hands are more marked on the right.

Neurological examination reveals bilateral flaccid paralysis of the muscles of the hand innervated by the ulnar nerve, more marked on the right side. There is a diminished sensation for touch and an absence of pain and temperature over the ulnar nerve area, more marked in the right hand. There is a loss of adduction of the fifth and sixth fingers which are flexed at the metacarpophalangeal joints. Trophic disturbances are present. Tendon reflexes are normal. The thumb-to-finger test is poorly performed.

#### DISCUSSION

Case 1 illustrates the following positive findings consistent with the diagnosis of syringomyelia, namely: The presence of an atrophic progressive paralysis of both arms and hands, more marked on the right, where the hand assumes the position of a "main en griffe"; the presence of a sensory segmental dissociation; diminished tendon reflexes of the upper extremity; a spasticity and weakness of the right leg, with hyperactive knee jerks and ankle jerks; a scoliosis of the spine; and a hypalgesia of the right side of the face.

Case 2 shows progressive muscular atrophic paralysis of the hands. Commensurate with the atrophy, there is weakness and dissociation of sensation. This case also presents a history of one of the earliest and most common signs of syringomyelia—burning of the fingers without consciousness of it.



Because of the protean symptomatology of syringomyelia and the number of diseases which have as their earliest and most frequent sign a "main en griffe," its diagnosis is exceedingly difficult and involved.

The diagnosis of syringomyelia depends upon the history, particularly the absence of trauma and chronicity, and the dissociated anesthesia and progressive muscular atrophy.

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#### NOTES ON THE PREPARATION OF THE MOUTH FOR PROSTHETIC DENTAL TREATMENT

By J. W. MILLER, Jr., Lieutenant, Dental Corps, United States Navy

The mouths of patients for prosthetic dental treatment must be in the proper condition for the reception of the completed dentures at the time of their admission to the hospital, if treatment is to be expedited and the period of hospitalization is to be reduced. It has been frequently found necessary to extract additional teeth after the patient has reported for treatment and the period of hospitalization has been prolonged correspondingly. Unfortunately, each case is a law unto itself, and it is impossible to devise inflexible rules for the guidance of the dental officer instituting the preliminary treatment. A few fundamental principles can be observed, however, and it is the purpose of this paper to call attention to them.

Patients should be referred to the prosthetic laboratory, if it is located in the vicinity, for a preliminary examination prior to the extraction of the teeth. At this time the most suitable type of replacement can be determined, preliminary data recorded, and intelligent recommendations made regarding the extraction of the teeth. Should this be impossible, snap modeling compound impressions should be taken and forwarded, together with röntgenograms of the remaining teeth, to the laboratory for study. This procedure requires very little time, but it is rarely followed.

An impression of the labial surfaces of the anterior teeth with the jaws in centric relation should be taken before any teeth in either arch are extracted. This is a relatively simple procedure and is of great assistance in reproducing irregularities of the anterior teeth in the completed denture. An oval piece of Ash's metal, or soft lead, wide enough to cover the labial surfaces of the upper and lower anterior teeth, is bent to conform to the contour of the arches. Half a sheet of modeling compound is softened and placed upon one side of this improvised tray. With the teeth closed in centric relation, the tray is carried to place, the lips compressed, and the compound permitted to harden. The shade or hue of the natural teeth should

also be taken and this information incorporated in the patient's record.

Extensive alveolectomy at the time of extraction is rarely indicated, although the alveolar process should be smoothed and sharp, uneven spiculæ of bone removed. The necessity for conservative surgical interference becomes more apparent after the tissues have been permitted to heal. If excessive protrusion of the upper alveolar ridges, undercuts, or exostosed tuberosities exist, they may then be reduced, but care must be exercised lest too much tissue be destroyed.

Immediate replacement may be desirable in a few cases where the loss of teeth would seriously interfere with the discharge of the patient's duties. In these cases the posterior teeth should first be extracted, the necessary surgery performed, and the tissues permitted to heal. The patient should then be transferred to the hospital, where the restoration is constructed before the anterior teeth are extracted.

Most of the restorations supplied in the naval service are partial dentures. If dentures of any degree of permanency are to be constructed, great care must be exercised in determining which teeth shall be retained. Isolated teeth should rarely be permitted to remain. Teeth which are markedly rotated, elongated, or have more than half of their investing tissues destroyed should be extracted. Despite instructions issued by the Bureau of Medicine and Surgery cases are frequently encountered in which the preliminary restorative work has not been done. Impression taking is greatly facilitated when all carious teeth have been filled, the restorations polished, and all remaining teeth have been scaled and polished.

Clinical observation teaches that patients who have undergone extensive antiluetic treatment seldom have sound teeth unless rigid oral hygiene has been maintained during their course of treatment. A condition simulating pyorrhea, possibly an arsenical necrosis, develops, and in many cases the alveolar bone seems to melt away. Caution in determining which teeth are to be retained should be exercised in these cases, for when the teeth are subjected to the added stress of clasps they soon loosen, extraction becomes necessary, and the patient must be readmitted to the hospital for further prosthetic treatment.

# NAVAL RESERVE

## MEDICAL CORPS

### APPOINTMENTS, SECOND QUARTER, 1932

Name	Rank	Appointed
Bassett, Sam A.....	Lieutenant (junior grade), MC-V (G).....	May 12, 1932
Carson, James G.....	do.....	Feb. 26, 1932
Gardner, Stanley.....	Lieutenant commander, MC-V (S).....	May 9, 1932
Garnett, Herman M.....	Lieutenant (junior grade), MC-V (G).....	Mar. 26, 1932
Key, Webb B.....	Lieutenant (junior grade), MC-V (S).....	Apr. 26, 1932
Maner, George D.....	Lieutenant, MC-V (S).....	Feb. 24, 1932
Moseley, Lonnie B.....	Lieutenant (junior grade), MC-V (S).....	Apr. 26, 1932
Munch, Otto L.....	Lieutenant (junior grade), MC-V (G).....	May 4, 1932
Owings, James C.....	do.....	Apr. 21, 1932
Shaw, Paul A.....	do.....	Apr. 1, 1932
Steele, Edson.....	Lieutenant, MC-V (S).....	Feb. 24, 1932
Watkins, Harry, C. jr.....	Lieutenant (junior grade), MC-V (G).....	Apr. 15, 1932

### PROMOTIONS

Name	From—	To—
Bowen, Harold J.....	Lieutenant (junior grade), MC-F.	Lieutenant MC-F.
Olesen, Arthur C.....	Lieutenant, MC-V (G).....	Lieutenant commander, MC-V (G).
Luckey, Robert C.....	Lieutenant (junior grade), MC-V (G).	Lieutenant, MC-V (G).
Randall, Samuel B.....	Lieutenant (junior grade), MC-F.	Lieutenant, MC-F.
Simpson, Walter M.....	Lieutenant, MC-V (S).....	Lieutenant commander, MC-V (S).
Wernum, Philip D.....	Lieutenant, MC-F.....	Lieutenant commander, MC-F.

### TRANSFERS

Name	From—	To—
Bostic, Sam C.....	Lieutenant (junior grade), MC-V (G).	Lieutenant (junior grade), MC-F.
Lilljencrants, Eric.....	do.....	Do.
Meehan, George E.....	do.....	Lieutenant (junior grade), MC-V (S).
Riebel, Francis A.....	do.....	Do.
Welsh, Clyde L.....	Lieutenant (junior grade), MC-F.	Lieutenant (junior grade), MC-V (G).

## DENTAL CORPS

### APPOINTMENTS, SECOND QUARTER, 1932

Name	Rank	Appointed
Barrow, Blendon C.....	Lieutenant (junior grade), DC-V (G).....	Apr. 5, 1932
Brady, Ewing P.....	Lieutenant commander, DC-V (S).....	Apr. 27, 1932
Levin, Harry L.....	Lieutenant (junior grade), DC-V (G).....	Apr. 1, 1932
Midgley, Albert L.....	Lieutenant commander, DC-V (S).....	Apr. 28, 1932
Thomas, J. E. L.....	Lieutenant (junior grade), DC-V (G).....	June 6, 1932
Weeth, Byron H.....	do.....	Apr. 28, 1932



## NOTES AND COMMENTS

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### COMMENTS ON SOME OF THE RECENT ACTIVITIES OF THE MEDICAL DEPARTMENT OF THE NAVY<sup>1</sup>

The majority of officers of the Medical Department of the Navy to-day are so occupied with the tasks immediately at hand that they have little, if any, opportunity to become familiar, even in a general way, with the vast amount of work that is being accomplished by the Medical Department of the Navy in the aggregate. You are now finishing an eight months' course of intensive work, and before taking up your new problems this occasion seems opportune to review in a general way some of the recent activities of our department.

During the past three years the activities of the Medical Department, and especially the volume of work in the naval hospitals, have markedly increased. The daily average of patients in 1929 was 4,945, and two years later the number had increased to 5,794. It is expected that the daily average for 1932 will be over 7,000 patients in all of our naval hospitals, or an increase of 40 per cent in the 3-year period. The last weekly report of sick in hospitals shows 7,608 patients under treatment, and two of our larger hospitals, New York and San Diego, have recently exceeded the census of over 1,000 patients.

With the increase in hospital patients there has been, naturally, a corresponding increase in hospital sick days. In 1929 there were 1,805,115 hospital sick days; in 1931, 2,115,126; and the number of hospital sick days for the current year will be well over the estimated total of two and one-half million.

I like to look upon the activities of the Medical Department as divided into two groups. One group consists of the hospital service that takes care of between 7,000 and 7,500 sick in hospitals. The other is the field service, which consists of duty on board ship and at foreign shore stations. The large hospital service occupies most medical and dental officers during their periods of shore duty. At the conclusion of shore duty the officer goes from the hospital to the field service. Consequently, he is well prepared for the care of the

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<sup>1</sup>Address by Rear Admiral C. E. Riggs, Surgeon General, U. S. Navy, delivered to the graduating medical and dental classes, U. S. Naval Medical School, May 14, 1932.

sick aboard ship, at foreign shore stations, or with the various expeditionary forces. I am sure that the entire Navy will sympathize with any scheme of things that delivers to those who are isolated aboard ship or who are on duty at small stations in distant lands a well-qualified medical service.

While the foregoing constitutes the major part of the work of the Medical Department of the Navy, there are other items that run into sizable figures annually, such as the 10,000 annual physical examinations of officers, 5,000 aviation examinations, 150,000 other physical examinations, 60,000 vaccinations, 90,000 administrations of arsenical compounds, and about one-half a million dental treatments.

None of the above figures includes the extensive medical service rendered to civilian employees at the navy yards and other shore stations and to the native populations of our island possessions and other countries where such service is provided by treaty requirements.

A number of activities not directly concerned with the care of the sick call for considerable work. For instance, submarines, deep diving, gas warfare, aviation medicine, and expeditionary forces are special lines of endeavor concerning which we must maintain an informed personnel. The Bureau of Medicine and Surgery is now cooperating with the Naval Research Laboratory in the study of improved methods for chemical air purification in submarines. Extensive research is also in progress, in conjunction with the Bureau of Construction and Repair, relative to certain problems connected with the submarine escape appliance or "lung," in order to reduce the hazard of escape with this appliance in a submarine casualty.

Investigations in certain fundamental physiological problems in deep diving are being conducted at the Harvard School of Public Health by representatives of the bureau. In conjunction with the Bureau of Construction and Repair, a comprehensive plan of research in deep diving has been adopted, the work to continue for a number of years at the experimental diving unit, navy yard, Washington, D. C. The object of these studies will be a modification of the present decompression tables, in order to reduce existing hazards. This has been found necessary as a result of difficulties encountered in the extensive diving operations in the salvage of submarines.

For the past 10 years the bureau has had a representative in the medical research division of the Edgewood Arsenal engaged in research in the medical aspects of naval chemical warfare.

In aviation medicine, ways to determine the qualifications of applicants for aviation training and the hygiene of aviation are receiving close study. This research is being directed toward the following subjects: Personality analyses; the explanation of the mechanism of depth perception; auditory fatigue and its relation

to radio reception; the significance of a moderate degree heterophoria; maintenance of equilibrium; respiratory problems arising as the result of flying at high altitudes. The hazard of carbon monoxide in relation to naval aircraft is being investigated by the bureau with the cooperation of the Bureau of Aeronautics. This work is still in progress, and the investigation has been extended to civilian aircraft.

Problems in preventive medicine arise from time to time which require investigation, such as improvements in the ventilation and air conditioning of surface ships and submarines, industrial hygiene at navy yards, and the control of various cosmopolitan and tropical diseases. Each year the Bureau of Medicine and Surgery compiles analyses of the vital statistics relating to the health of the Navy. This information is published in the annual report of the surgeon general, making this document of unusual value to those interested in preventive medicine.

As there has been no increase in the personnel of the Medical Department, and in particular no material increase in the staffs of the various hospitals, it is plainly evident that the output of work on the part of a large percentage of the personnel is far greater to-day than it was three years ago.

Up until a few years ago the distribution of personnel having knowledge and experience in special fields became somewhat unbalanced. Certain specialties were top-heavy with men in comparison to other equally important specialties.

To correct the situation and to avoid a similar occurrence in the future, a policy concerning postgraduate instruction was formulated in November, 1929. A board was formed to estimate the current needs as to the number of personnel required in the various specialties, to select personnel for assignment to courses of postgraduate training in order to meet these needs, and to formulate the bureau's policies in regard to the general matter of postgraduate training.

The board has since met at frequent intervals. Its studies have resulted in the arrival at more exact estimates as to present and expected specialist needs, and its functioning has brought about very gratifying progress in the way of a program which is now removing the shortage in certain fields.

The bureau desires to assist those who are anxious to develop themselves in a chosen field, and at the present time assistance is being given in the following ways:

(a) For younger medical and dental officers, particularly those in the rank of lieutenant, assignment to instruction at naval hospitals and the Naval Medical School.

(b) Supplementing this instruction, favorable action, when practicable is given requests for special courses at civilian institutions.

(c) Favorable action, when practicable, is likewise given requests for refresher courses from officers already established in a specialty.

(d) Assistance along similar lines is extended to pharmacists, nurses, and Hospital Corps men.

In the past four years more than \$52,000 were spent in civilian institutions for 225 medical officers, 26 dental officers, 9 pharmacists, 26 nurses, and 19 corps men. In addition to this, 60 medical officers, 30 dental officers, and 150 corps men received special instruction at the Naval Medical School.

It seems unnecessary to point out that without proper material and equipment it would not be possible for the Medical Department to do its best work. Since the World War the Navy has been housing a large percentage of its sick in temporary structures that were hurriedly built as a war measure. At the Washington Naval Hospital, for example, over 50 per cent of the patients are cared for in temporary and unsightly buildings, and at Philadelphia the entire hospital consists of such buildings.

The necessity of a building program to begin the replacement of those war-time structures was very apparent. Therefore, in 1929 such a program was begun, and since that time new construction of importance has been carried out at the hospitals at Newport, Chelsea, and Puget Sound and at other Medical Department activities.

Legislation has been enacted authorizing the erection of a new complete hospital at Philadelphia and a practically new hospital here in Washington. A site has been selected and purchased for the new Philadelphia hospital, and the plans of these magnificent buildings are nearing completion.<sup>1</sup>

Along with the increased activities of the Medical Department, it is a source of gratification to state that during recent years, when it has been most essential that the Medical Department demonstrate efficiency and economy, the total expenditures per man per year for medical care have been reduced from approximately \$105 in 1929 to \$95 in 1931, or a reduction in cost of \$10 per man. This figure multiplied by 110,000, the present strength of the Navy, represents an annual saving of more than a million dollars. Therefore, the 6,000 persons who make up the Medical Department are now delivering a hundred cents' worth of the highest type of service for every single dollar appropriated for Medical Department activities.

In closing I want to say that I remember attending a course of instruction at the laboratory at the Brooklyn Naval Hospital during

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<sup>1</sup> At the close of the fiscal year 1932 there had been authorized for expenditure from the naval hospital fund a total of \$1,300,000 for the construction of the new naval hospital at Philadelphia.



the summer of 1894. This course had been established by the then Surgeon General, J. Rufus Tryon, who was a progressive type of naval officer. His four years of office as Surgeon General witnessed many forward steps in the professional accomplishments of the Medical Corps of the Navy. Yet at that time none of those activities or branches of knowledge which make this school so essential to-day were in existence as medical specialties. I refer to the medical aspects of aviation, gas warfare, deep diving, submarines, and many phases of naval hygiene and sanitation.

Another Surgeon General who greatly added to the efficiency of the Medical Corps of the Navy was Rear Admiral Presley M. Rixey, who was appointed Surgeon General in 1902. He reestablished this school in its modern form and gave the service many points of advancement, among them some of our new modern hospitals. Naturally, it is our pleasure to give credit to those men who have gone before us and whose farsightedness established much that is of benefit to us to-day. We are now in their places, so to speak, so let us build with the view to permanency and satisfaction. In doing so I know of no better watchwords than efficiency and economy. The standing and reputation of the Medical Department of the Navy depend upon the quantity and excellence of the output of the individual members of that department. This refers to doctors, dentists, nurses, and Hospital Corps men. I want you to understand that the hundreds of letters that come to the bureau in praise of the Medical Department are not limited to any particular group of persons. They apply to all branches, and attest that proper recognition for duty well performed is distributed through all ranks of our department. I can also tell you, as I have ample authority for the statement, that the recognized efficiency of the Medical Department of the Navy was never higher than it is to-day. You are among those to whom is intrusted the task to see that this statement is always justified. I am confident you will do your part.

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#### **SURGEON GENERAL OF THE NAVY HONORED**

Rear Admiral Charles E. Riggs, Surgeon General, United States Navy, was conferred an honorary fellowship in the American College of Dentists at the last annual meeting of the college held in Memphis, Tenn., in recognition of his services and devotion to the advancement of the science and art of dentistry. This is the first time that the American College of Dentists has conferred this honor upon a member of the medical profession.

Admiral Riggs, it will be recalled, also holds an honorary membership in the Association of Military Surgeons of Mexico, con-

ferred at the Denver meeting of the Association of Military Surgeons of the United States.

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#### AMERICAN COLLEGE OF SURGEONS

The American College of Surgeons this year, as in previous years, has generously invited the Surgeon General to nominate a specified number of medical officers as candidates for fellowship in the college.

The medical officers that have complied with the requirements set forth below and have been nominated for the current year are:

Lieut. Commander Melville J. Aston, Medical Corps, United States Navy.

Lieut. Commander Arthur H. Dearing, Medical Corps, United States Navy.

Lieut. James R. Fulton, Medical Corps, United States Navy.

Lieut. Commander Jesse D. Jewell, Medical Corps, United States Navy.

Lieut. Commander Felix P. Keaney, Medical Corps, United States Navy.

Lieut. Commander William T. Lineberry, Medical Corps, United States Navy.

Lieut. Commander Kenneth E. Lowman, Medical Corps, United States Navy.

Lieut. Commander Leslie B. Marshall, Medical Corps, United States Navy.

Lieut. Charles G. McCormack, Medical Corps, United States Navy.

Lieut. Dwight J. Wharton, Medical Corps, United States Navy.

The Nineteenth Year Book (1932) of the American College of Surgeons lists 184 members of the Medical Corps, United States Navy, as fellows of the college. The list, however, shows that only a little over 50 per cent of the medical officers now specializing in general surgery or in special fields of surgery, such as eye, ear, nose, and throat, genitourinary surgery, orthopedics, gynecology, and obstetrics, are members.

Assuming that the privilege will be extended to the Navy again next year, it is suggested that officers desiring to have their names considered for nomination submit their applications not later than July 1, 1933.

Although for officers of the Navy fellowship is made a matter of courtesy, it nevertheless seems proper that there should be presented as candidates only those officers who are fully qualified for fellowship in accordance with the standards set by the college. Consequently it is the fixed policy of the bureau to stand sponsor for only those officers who, in the opinion of the bureau, meet the high standard of professional qualifications set by the college and who are

prepared to comply with all the professional requirements imposed by the college on candidates from civil life. Should the number of qualified applicants exceed the number of nominees permitted, the order of selection will be according to relative merit.

To be eligible for fellowship without technical examination the candidate shall be a graduate, of at least seven years' standing, of a medical school approved by the American College of Surgeons.

The candidate shall give evidence that he has served at least one year as interne in an accredited hospital and two years as surgical assistant, or he shall give evidence of apprenticeship of equivalent value. As a means of furnishing precisely the information desired, it is requested that the "application for fellowship" (obtainable from the bureau) shall be filled out and submitted with the applicant's case reports.

Letters also may be submitted by the candidate testifying as to his personal traits as well as to his professional qualifications.

The professional activity of the candidate shall be restricted to the study, diagnosis, and operative work in general surgery or in special fields of surgery, such as eye, ear, nose, and throat, genito-urinary, orthopedics, and gynecology and obstetrics.

As evidence of his qualifications in the technique of surgery, the candidate is required to submit in complete detail through official channels, the case records of 50 consecutive major operations which he has performed himself.

In addition to the complete records of 50 consecutive major operations, the candidate is asked to submit in brief abstract a report of at least 50 other major operations in which he has acted as assistant or which he has performed himself.

The senior medical officer with whom the candidate is serving, when forwarding these case records and the abstract of major operations in which the candidate has assisted, shall furnish, by means of an appropriate indorsement, his estimate of the candidate's qualifications for fellowship.

The attention of prospective candidates is invited to the desirability of having case reports typed on paper of cap size, suitably arranged and bound, and prefaced by both an index to cases (Form P) and a summary giving the total number of operations of each type; e. g., appendectomy, 14; cholecystectomy, 2, etc.

It is important further that each case be identifiable by recording (a) institution; (b) hospital number; (c) date; (d) initials.

**AMERICAN COLLEGE OF PHYSICIANS**

Several years ago the board of regents of the American College of Physicians adopted a resolution providing that candidates for membership from the Navy shall be proposed by the Surgeon General of the Navy.

The intent of the board of regents was to provide that all applications from officers of the Medical Corps of the Navy shall be forwarded through the office of the Surgeon General of the Navy, who will forward the applications to the college with a letter of indorsement. Candidates so proposed will be required to submit all the data and meet all the usual requirements for associateship, and will be passed upon individually by the committee on credentials for associateship, the board of governors, and the board of regents.

1931 was the last year that candidates could be elected directly to fellowship, except in very special cases. The exceptions, according to a letter recently received from E. R. Loveland, the executive secretary of the college, will only be considered in cases of outstanding internists. He states:

"It is thought by our board of regents, and so provided, that, in an exceptional case, some nationally known authority in the field of internal medicine might be admitted directly to fellowship."

The term of associateship and eligibility for fellowship, to quote Article VI, section 3 of the by-laws, follow.

"Candidates elected after the adoption of this section (April, 1929) shall be elected for a term of five years.

"An associate so elected shall be eligible for election to fellowship at the end of three years after his election to associateship. At the expiration of three years he shall be notified in writing by the joint committees on credentials of his eligibility for election to fellowship during the next two years, provided he shall meet within that time the requirements necessary for fellowship. If not elected to fellowship within five years, his associateship will automatically cease."

At the present time, according to the 1931-32 Directory of the American College of Physicians, there are 41 members of the Medical Corps listed as fellows and 3 members listed as associates.

Application blanks may be obtained by request from the Bureau of Medicine and Surgery.

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**POSTGRADUATE BOARD**

The Surgeon General, on April 16, 1932, appointed a new board to make study and recommendations in connection with the post-graduate instruction of officers, nurses, and hospital corps men.

The board consists of the following members:

Admiral A. W. Dunbar, Medical Corps, United States Navy; Capt. O. J. Mink, Medical Corps, United States Navy; Capt. D. C. Cather, Medical Corps, United States Navy; Capt. C. W. O. Bunker, Medical Corps, United States Navy; Capt. E. W. Brown, Medical Corps, United States Navy; Commander P. G. White, Dental Corps, United States Navy; and Lieut. Commander J. Harper, Medical Corps, United States Navy.

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#### ARSENOXIDE FORMATION FROM ARSPHENAMINES

Sanford M. Rosenthal, of the National Institute of Health, United States Public Health Service, reports in the United States Public Health Service weekly report of April 22, 1932, the results of experiments in connection with the formation of arsenoxide from the arspenamines in the living animal and in test-tube oxidations.

This work was conducted to confirm the theory of Voegtlin and Smith that the parasitocidal action of the arspenamines is due to their conversion in the body of the host into a compound of the arsenoxide.

According to Rosenthal, it became necessary to modify Ehrlich's view of a direct action of the arspenamines on the parasite as a result of the demonstration by Hata and other investigators that arspenamine and neoarsphenamine are, in the test tube, relatively nontoxic toward spirochetes and trypanosomes. This led to several explanations for the action of these drugs, among them the stimulation of antibody formation and a change of the drug within the host or parasite to a compound of greater parasitocidal value.

Ehrlich and Bertheim then discovered that arsenoxide formed when arspenamine is allowed to undergo oxidation in the air, and later Voegtlin and Smith found that arsenoxide was several hundred times as trypanocidal *in vitro* as the arspenamines.

To support their theory, Voegtlin and Smith showed "that in rats infected with *Tr. equiperdum* the trypanocidal action of intravenously injected arspenamine and related arsenobenzene compounds is always preceded by a latent period of two to three hours, while with compounds of the arsenoxide type the trypanosomes begin to disappear from the blood immediately. They further found that solutions of arspenamine and neoarsphenamine that had undergone partial oxidation in air manifested a corresponding reduction of their latent period."

The final proof of the arsenoxide theory, however, according to this investigator, "has awaited more complete information concerning the formation of arsenoxide from arspenamine *in vitro*, and the demonstration of arsenoxide in the tissues of animals following the injection of the arspenamines."

A color test, the naphthoquinone reaction, which will differentiate between the arsphenamines and arsenoxide, was developed, and with this test confirmatory evidence was obtained that arsenoxide is formed from arsphenamines, both in the living animal and also in test-tube oxidations.

The author's discussion of the results of the investigation follows:

The recovery of considerable amounts of arsenoxide from the liver of the rat following the injection of arsphenamine and from the kidney following neoarsphenamine confirms the theory of Voegtlin and Smith that arsenoxide is formed from these compounds in the living body. In harmony with their view, that this compound is responsible for the trypanocidal action, is the fact that the interval of time required before arsenoxide can be demonstrated in the tissues is similar to the latent period required by these drugs before their trypanocidal action in the body is manifest.

It will also be observed from results obtained following the injection of lethal doses of arsphenamine that there is fixed in the liver an amount of arsenoxide which would be fatal if injected intravenously. This evidence supports the view of Voegtlin that the toxicity of arsphenamine to the host is due to arsenoxide. Dale has emphasized the importance of the slow liberation into the circulation of arsenoxide from arsphenamine as a basis for therapeutic efficiency and safety to the host. Jackson and Raap showed that the severe circulatory disturbances resulting from the peripheral intravenous injection of arsphenamine were largely absent if the drug was injected into the portal vein. The general circulatory effects and pulmonary lesions produced by arsenoxide play an important rôle in the acute toxicity of this compound, and its formation from arsphenamine in certain tissues, with subsequent fixation there, would permit larger amounts to be present in the body without general toxic effects.

The actual concentrations of arsenoxide present in the tissues may be slightly higher than those obtained in our experiments, since complete recovery of arsenoxide added to an organ is not always possible. One factor that may be responsible for the incomplete recovery may be the presence of glutathione, which we have found inhibits the color reaction if present in considerable amounts. However, nitroprusside tests upon the filtrates of normal and arsenic-containing organs have been negative, which leads us to believe that under these conditions the glutathione is precipitated out by the silver used in the extraction.

The differences in distribution of arsenoxide following arsphenamine and neoarsphenamine injections are of particular interest in view of a similar distribution of the pathological changes produced by them. Arsphenamine produces lesions principally in the liver, while with neoarsphenamine the pathological changes are chiefly in the kidney (Kolmer and Lucke). Since the studies of Fordyce, Rosen, and Myers reveal that the concentrations of arsenic which are reached in these organs are very similar when large doses of either arsphenamine or neoarsphenamine are injected into rats, our experiments would suggest that it is not the total arsenic but the arsenic in the form of arsenoxide that plays an important part in the production of these pathological effects.

The naphthoquinone reaction can be applied as a corollary to tests of toxicity upon commercial samples of arsphenamine. We are investigating the problem of toxicity of samples of arsphenamine as related to their arsenoxide content. A future communication will be published upon this subject.

**EXPERIMENTAL YAWS: 1.—COMPARISON OF THE AVAILABILITY OF THE RABBIT AND MONKEY FOR THE ISOLATION OF STRAINS OF YAWS**

In an article bearing the above title, Dr. Thomas B. Turner and Lieut. Commander J. H. Chambers, Medical Corps, United States Navy, present in the April, 1932, number of the Bulletin of the Johns Hopkins Hospital the first of a series of experiments dealing with the question of whether or not yaws and syphilis are identical diseases.

They preface their work with the following comments:

The question of the relationship of yaws to syphilis has been for years a fruitful source of speculation and is still under discussion. The problem has been approached from several angles, of which one has been that afforded by the experimental method. The present communication is the first of a series dealing with experiments designed to throw light upon the question whether or not yaws and syphilis are identical diseases. The experiments that will be reported in subsequent papers record attempts to determine whether yaws, experimentally induced, is similar to experimental syphilis, and whether there is any immunological relationship between strains of spirochetes recovered from yaws patients, on the one hand, and from syphilitic patients, on the other. Previous observers have made similar comparisons of these experimental infections, but not, so far as we are aware, with strains of yaws and syphilis spirochetes recovered in the same locality. This seems to us an important point, and for that reason we sought to obtain such strains from persons in the same country and belonging to the same race.

Although methods for establishing a syphilitic infection in experimental animals were well known, a review of the literature prior to undertaking the present study on the subject of the transfer of yaws from man to animals afforded the authors little information as to how this could best be accomplished. In this paper, therefore, we wish, first, to record, for the benefit of others, our experiences in transferring yaws virus to two types of laboratory animals, rabbits and monkeys; and, secondly, to establish for future reference the identity of several strains of yaws and one strain of syphilis virus which we have isolated.

The nature and source of the material, the technique of collecting the material, the method of inoculation used, and the results obtained are described in detail.

The authors summarize their work as follows:

The results of these experiments may be summarized in the following manner. In a parallel series of inoculations in which yaws virus obtained from patients was introduced into rabbits and monkeys, 8 out of a possible maximum of 10 strains were isolated and carried successfully through a second generation of rabbits. In each instance the strain was recovered through intratesticular inoculation of rabbits, whereas in no instance could it be recovered from the monkey or through intracutaneous or granulating-wound inoculation of rabbits. It is realized that the number of monkeys inoculated was small; moreover, it is difficult to reconcile the disappointing results obtained in them with the work of some of the earlier observers. Nevertheless, this comparison between the availability of the monkey and rabbit for the isolation of *T. pertenue* appears to be a reasonable one, for the two species were inocu-

lated under similar conditions with approximately equal amounts of the same virus. Aside from the difference in the number of positive results, the rabbit, on account of economic factors, ease of handling, and time saved, is the more satisfactory animal for purposes of inoculation. The point is stressed, not alone from the standpoint of the isolating of strains of yaws spirochetes—for, after all, the necessity for such presents itself infrequently—but because it would seem to apply as well to any investigation demanding the transfer of tissue from man to animals in the search for *T. pertenue*.

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#### SKIN ERUPTIONS FROM BISMUTH THERAPY IN SYPHILIS

In all of 22 cases of skin eruptions from bismuth therapy observed by Edward A. Skolnik and Irma Aleshire, Chicago (Journal of the American Medical Association, May 21, 1932), the eruptions that developed as a manifestation of bismuth sensitivity have never previously appeared in the patients. The exanthems occurred during the administration of bismuth and ceased after the withdrawal of the drug, though some of the common skin disorders which they simulated are notably refractory to therapy. Since the eruptions in this series were so benign and resembled some of the usual skin diseases, the authors felt justified in reproducing the condition a second or even a third time to prove the etiologic rôle of the bismuth. Thirteen of the cases were tested and proved in this fashion. The mildness of the eruption is best illustrated by those cases in which the use of bismuth was continued in spite of the sensitivity, some of these patients gradually becoming desensitized. In contrast to these cases, there are reports in the literature of cases comparable in severity to those of arsphenamine dermatitis. The acute types of rash produced were the urticarial, folliculopapular, exfoliative, and the erythematousquamous, which resembled pityriasis rosea. The chronic types were the lichen planuslike and the chronic lichenified form, simulating lichen simplex chronicus. By far the greater number, 14, were in the pityriasis rosealike group. The incidence of skin reactions was approximately 1 in 1,140 bismuth treatments. Of the 22 cases reported, 10 were in the Negro race, which is a much higher incidence than in the white race, considering the relative attendance of the two in the syphilis clinic. Reactions occurred with all the preparations used, which were an oil suspension of potassium bismuth tartrate, an aqueous solution of bismuth sodium tartrate, and an oil suspension of bismuth salicylate. The eruption was reproduced in several instances by a different preparation of bismuth, indicating that the sensitization was to bismuth alone. These reactions developed in patients undergoing treatment for all stages of syphilis. In no case was there sensitivity to neoarsphenamine, although one man showed a marked sensitivity to mercury.



Other than the skin lesions, there were no subjective or objective manifestations attributable to the bismuth, except in two cases with moderate stomatitis and in another case with severe nausea and icterus. No serologic change attributable to the nonspecific action of the eruptions (esophylaxis) was found after their healing.

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**DIFFERENTIAL DIAGNOSIS BETWEEN TYPHUS AND SPOTTED FEVER:  
REPORT OF CASE AND ISOLATION OF A NEW MILD TYPE OF SPOTTED  
FEVER VIRUS**

Hobart A. Reimann, Henry L. Ulrich, and Luther C. Fisher, Minneapolis, writing in the May 28, 1932, number of the Journal of the American Medical Association, present the clinical report of a case which was at first believed to be typhus fever but proved to be spotted fever after immunity experiments had been made. Emphasis is laid on the necessity of biologic procedures in determining an etiologic diagnosis. Differentiation on the grounds of clinical epidemiologic, or pathologic data is uncertain. Studies of the reaction of the virus after its establishment in guinea pigs indicated a number of features which distinguish it from other strains of rickettsial disease thus far reported. A low virulence for guinea pigs, scrotal swelling, and the presence of rickettsia in the scrotal exudate resemble the reaction of typhus more than that of spotted fever. On the other hand, the results of the immunity tests pointed to a closer relationship with spotted fever. The conflicting results of several tests, namely, the failure in two instances of the Minnesota strain to confer immunity against western spotted fever, as found by Dyer, and the apparent protection conferred by typhus fever against the Minnesota strain in the authors' experience, are puzzling. These results suggested that the Minnesota strain might be of an intermediate variety. The authors feel, however, that another explanation is likely. The Minnesota strain produces a comparatively mild disease in guinea pigs and may thereby evoke weak immunity, too weak to protect regularly against a strain of such high virulence as the Bitter Root variety of spotted fever. On the other hand, endemic typhus may conceivably confer a certain grade of nonspecific immunity which is sufficient to protect guinea pigs against the weakly virulent Minnesota strain. But from the results of other tests, namely, the reciprocal immunity conferred by the Minnesota strain and eastern spotted fever, and by the protection conferred against infection with the Minnesota strain by spotted-fever vaccine, it appeared that the Minnesota strain represents an exceptionally mild type of spotted fever.

### THE NEWER CONCEPTION OF DIPHTHERIA IMMUNIZATION

The present status of diphtheria immunization is reviewed, under the above title, in the symposium section of the International Medical Digest of March, 1932.

Based on experience and a study of the recent literature, the following conclusions are considered justified:

1. All children excepting those showing decided allergic tendencies should be given the benefit of active immunization against diphtheria during the pre-school age (6 months to 6 years) without a preliminary Schick test.

2. The best means of accomplishing this is by the administration of not less than two nor more than three 1 cc doses of diphtheria toxoid (Ramon anatoxin) at intervals of three weeks.

3. Children of the school age and adults show more local and general reactions to the bacterial protein of toxoid, so that an intradermal test for sensitiveness should be performed before administering the immunizing injections. If evidence of sensitiveness appears within three days after the intradermal test, the doses of toxoid should be altered and given as follows: 0.1, 0.25, 0.5, 1, and 1 cc of diphtheria toxoid at intervals of one week instead of three weeks.

4. The great susceptibility of the preschool child justifies the elimination of the preliminary Schick test, but it is desirable to perform a preliminary test on older children, especially in urban communities, where the opportunity is favorable for acquiring active immunity from exposure to attenuated infections.

5. Rural children show a greater susceptibility to diphtheria, as indicated by more Schick positives, than city children.

6. It is believed that toxoid will soon replace toxin-antitoxin as an immunizing agent. Toxoid is from 20 to 30 per cent more effective, even in only two doses; it contains no serum to sensitize to later therapeutic sera, it contains no free toxin, it is more stable, and is not affected by freezing.

7. Toxin-antitoxin should be protected against freezing, which is especially likely with modern electrical refrigeration.

8. In the newer conception of diphtheria immunization, it is believed that many of the difficulties which occur in the developmental period of every new departure have been overcome. While the whole procedure of active immunization has been greatly simplified, it is still necessary to use a certain amount of discrimination, and the application of the methods should remain in the hands of physicians, and should not be intrusted to their subordinates. Moreover, it behooves the physician to put forth every effort to inform himself concerning the latest developments, possibilities, and limitations of active immunization against diphtheria.

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### PHYSIOLOGIC DEATH AND ARTIFICIAL RESPIRATION

Accidents frequently happen in which the victim seems to have been fatally injured and yet the vital organs have not wholly ceased to function. Respiration may cease and the heart stop functioning, producing a state of physiologic death, during which time the victim may sometimes be revived by the proper administration of artificial respiration. This may occur in such accidents as drown-

ing, electrocution and asphyxiation, and in some automobile accidents. The unfortunate and apparently dead victims may not actually die for some time following the accident. Von Hoesslin reported before the Berlin Medical Society that the electrocardiograph has demonstrated regular contractions of the heart continuing as long as 80 minutes after physiologic death occurs. The contractions are strongest immediately following the accident and grow weaker gradually until the heart ceases entirely to function, except for occasional contractions which occur at regular intervals. Therefore, it would be the period immediately following the accident that normal life may be restored by artificial respiration. Dr. Samuel R. Benedict, of the Alabama Power Co., believes that many people have died following injuries when they might have been resuscitated if artificial respiration had been promptly administered. The large electric power companies have first-aid teams composed of their employees who are expert in the administration of artificial respiration. These teams have been trained primarily to revive workmen who happened to come in contact with highly charged and dangerous electrical equipment. The public utility companies have thus been able to save the lives of many of their employees. If these companies have not already done so, they should inform the communities in which their expert first-aid teams are located that they are available at any time to administer artificial respiration to any person in the community who happens to be the victim of some such accident. The public utility companies could render a still greater public service if they would offer to provide instruction to the public in the proper methods of artificial respiration. Thus, in extending a service in which some other organizations are already engaged, additional valuable lives may be saved.—*Journal American Medical Association*, April 23, 1932.

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#### INTESTINAL TRACT AND DIET IN ARTHRITIS

Under the heading "The relation of the intestinal tract and diet to the treatment of arthritis," Ralph Pemberton and E. G. Peirce report and discuss, in the April, 1932, number of the *Annals of Internal Medicine*, a series of both atrophic and hypertrophic arthritic cases in which marked improvement followed dietetic therapy.

Summarizing the results of their work, they state:

Attention has previously been drawn to the frequency with which the syndrome of chronic arthritis, both atrophic and hypertrophic, is accompanied by enlargement and tortuosity of the large bowel. Corroboration is afforded, in the present contribution, of the work of Fletcher, who has shown that, with institution of the type of diet previously described by one of the present writers,

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the bowel so distorted may return to or toward a normal contour. Apparently the condition described may sometimes be congenital or it may be acquired. Once established in the course of cases of different primary etiology, the condition described may constitute an additional contributory factor in perpetuating the disease. Arthritis may thus be originated by an infection, the removal of which in no way influences secondary consequences of this nature. It is equally probable that the above configuration and ensuing dysfunction of the intestinal tract also constitute an originally exciting factor in the production of the disease.

Dietetic therapy affords the *sine qua non* of successful treatment in a large number of cases of arthritis. *Such therapy should be applied, however, to appropriate cases only, and on the basis of a familiarity with the principles concerned and with the limiting factors to which references are given in the text.*

In amplification of earlier work, it is shown that under conditions of under-nutrition approaching starvation, not only may the active symptoms of the disease subside but there may be also, occasionally, an absorption of detritus or pathological exudate in or around joints, nearly or quite ankylosed, which reduces the amount of limitation to motion imposed by the existing fibrous contractures. In *suitably selected cases* the gain so achieved, though necessarily of small extent because of bony impingements and the like, may have great significance for the activities of the patient.

Finally, preliminary report is made of the fact that cases of both types of arthritis have experienced sharp improvement upon low calorie diets from which all vitamins were definitely excluded. While in no way negating the rôle of the vitamins in relation to the rheumatoid syndrome as a whole in the sense above discussed, it is clear that the reduced food intake and not the presence of vitamins primarily determined the immediate and sharp benefit observed.

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**TRICHINIASIS: REPORT OF OUTBREAK CAUSED BY EATING TRICHINOUS  
BEAR MEAT IN THE FORM OF "JERKY"**

Writing in the June 11, 1932, number of the Journal of the American Medical Association, Albert T. Walker, lieutenant (junior grade), Medical Corps, United States Navy, naval hospital, Mare Island Calif., reports a fatal case of trichiniasis in a youth, aged 18 years, who joined a party of hunters in Trinity County, Calif., and brought down a brown bear weighing about 400 pounds (180 kg), age not determined. The bear was skinned, and as there was a large amount of meat to be disposed of, it was decided to "jerk" it and keep it for later consumption. The process of "jerking" consists in cutting the meat in strips, then smoking and drying it in the sun for a few days. The end result is a strip of black meat 18 inches long, 2 inches wide, and one-half inch thick, rather tough and leathery and not particularly palatable. About seven days after eating his first jerky, the youth became ill with nausea, vomiting, diarrhea, and generalized pain in the abdomen, which lasted two or three days and subsided. He continued to chew the jerky at odd

times over a period of several days, and three or four days later he became ill with fever, malaise, anorexia, prostration, and pain and stiffness in the muscles of the gastrocnemius groups. He continued to get worse; the muscular pains became quite severe; the temperature was high with large daily swings; he was unable to move his limbs; and he rapidly became delirious and died. The rest of the patient's family were lightly infected, except one sister, who had a severe attack. Encysted trichinellæ were found in sections made from the bear meat and also were recovered from muscular tissue of the diaphragm and pectorals at the necropsy of the patient who died of the effects of the disease. The outstanding clinical features of the case were the typhoidlike symptoms, chills and fever, a high leukocyte count with marked polymorphonuclear reaction during the height of the disease, the absence of muscular pain in one of the five patients, edema of the eyes in only two of the five, and the occurrence of the characteristic eosinophilia only during the period of convalescence.

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**THE VALUE OF TUBERCULIN TESTS IN MAN, WITH SPECIAL REFERENCE  
TO THE INTRACUTANEOUS TEST**

Under the title above, Dr. P. D'Arcy Hart, in the Special Report Series, No. 164, Medical Research Council, reviews the present position with regard to tuberculin as a diagnostic agent, and gives his observations of the reaction of 1,030 clinical tuberculous patients of all ages and all types of infection, in contrast with those of 751 clinically nontuberculous patients of all ages.

The author's conclusions are as follows:

1. The intracutaneous method is the most satisfactory tuberculin test in man, and should take the place of the subcutaneous and cutaneous (Von Pirquet) methods for all purposes.

2. A positive tuberculin reaction indicates that the individual has at some time been infected by the tubercle bacillus; a negative reaction excludes the presence of infection with an accuracy depending upon the method and dosage used.

3. A positive response in infancy, more than at any other age, suggests that the tuberculous infection is progressive, that clinical tuberculosis is—or soon will be—present, and that the outlook is unfavorable. While its absolute value in these respects appears to be less at the present time than it was formerly believed to be, tuberculous disease should be suspected and the prognosis guarded in such cases, especially if obscure and persistent symptoms are present or the conditions of living are bad.

A positive reaction in a young child aged 2 to 5 and showing symptoms should suggest that these symptoms are tuberculous in origin.

4. In patients over 5 years of age the value of the positive test in the diagnosis of clinical tuberculosis is practically limited to observations made with weak dilutions of tuberculin, administered by the intracutaneous route. The interpretation of these observations requires considerable experience, and

until wider use has been made of the methods they are not recommended for routine practice.

5. Tuberculin tests are of doubtful value in estimating the prognosis in clinical tuberculosis. According to some workers, however, useful information may be obtained from repeated intracutaneous tests.

6. When the conditions under which infection protects against, rather than produces, active disease are more fully understood, tuberculin tests may assume an important rôle in distinguishing immune from nonimmune healthy subjects.

7. Conclusions must be drawn with caution from a negative Von Pirquet test, owing to the relative insensitiveness of this method. A negative tuberculin reaction, obtained by the intracutaneous method when used in the manner recommended, excludes clinical tuberculosis with a very small error, except in patients tested a few days before death. The widely held opinion that the usefulness of tuberculin tests for the negative diagnosis of clinical tuberculosis is limited to only childhood is incorrect. At the present time the intracutaneous test can be profitably applied for this purpose at all ages up to adult life in large cities, and possibly even in adults who belong to the wealthier classes or who live in the country.

An increase in the advantage derived from using the intracutaneous test to exclude clinical tuberculosis will accompany any fall in the incidence of positive reactions among the apparently healthy members of the population, because this fall will increase the chance that a suspect patient whose clinical condition is really nontuberculous is free of all tuberculous infection and will therefore give a negative reaction.

8. The diagnosis of tuberculosis in childhood should never be made without performing a tuberculin test, unless there is clear bacteriological or pathological evidence of the disease.

9. Tuberculin tests have a special application in certain skin conditions, e. g., lupus pernio and the sarcoids, which, although believed to be tuberculous in origin, appear to be associated with loss of tuberculin reactivity. Here a positive reaction is evidence against the diagnosis, while a negative response, demonstrated by the intracutaneous method in maximal doses, strongly supports it.

10. Estimations of the tuberculosis death rate in the tuberculin-sensitized population at each age period at the present time indicate that this is higher in infancy than in older children \* \* \*. It is to be hoped that these rates will fall in the future. Should this fall principally affect infants, tuberculous infection may cease to be most fatal in early life.

11. Positive tuberculin reactions are more frequent among children of tuberculosis households than among children whose homes are free of clinical tuberculosis. Children who have tuberculosis relatives not living with them also run the risk of infection, depending on the intimacy of their contact with these relatives. Nonpulmonary and closed pulmonary tuberculosis do not appear to be sources of infection.

12. It is suggested that steps should be taken to improve the present methods of preventing tuberculosis in children of tuberculous parents. The formation of further settlements of the Papworth type might possibly be considered, together with a voluntary system for the separation of infants from their parents before infection, as shown by a positive tuberculin reaction, has taken place. These infants should be placed in healthy families for a period of several years. If infection has already occurred, the advantage of separation is less certain.

Home conditions are an important factor in the fate of children living in tuberculous families, and their amelioration may compensate to a certain extent for the presence of an infective adult. Whether this result is due more to prevention or limitation of infection than to an effect on its subsequent course in the body is not yet clear.

13. Variations in the incidence of positive reactions in different sections of the community, when not due to technique, can be usually accounted for by differences in the opportunities for exposure to contagion.

14. Correlation between the various tuberculin surveys is made difficult by the diversity of methods used. Until workers adopt a uniform technique and use a tuberculin whose potency is known in terms of the international standard tuberculin, little further progress is likely to be made. Meanwhile greater importance must be attached to the results obtained by using the intracutaneous method or the *stichreaktion* than to those based on the Von Pirquet test.

15. The belief, based on the results of some of the prominent earliest tuberculin surveys, that tuberculous infection is universal in later childhood among the poorer classes or general population of urban communities does not appear to be true at the present time of London and some other European and American cities, where a third or more of the clinically nontuberculous children react negatively to the intracutaneous test at the age of puberty. In certain instances, however, extensive tubercularization has been noted recently.

16. A reduction in the incidence of tuberculin sensitization in the community may be expected to follow a further decline in the phthisis death rate, improvement in the standard of living, and public measures directed to the limitation of exposure; e. g., by pasteurization of milk. There is already some evidence of a reduction among children in a few cities during the last 20 years, but further information is needed before the significance of this change can be assessed. The reduction is believed to be the manifestation of postponement of first infection.

17. Tuberculous infection in London children of the poorer classes appears at the present time to be acquired for the most part in later childhood and adolescence; i. e., during a period when the principal activities of the individual are away from the home. Almost all are sensitive to tuberculin when adult life is reached.

18. Systematic tuberculin tests on children may throw light on a new clinical entity—a transient and benign illness accompanying tuberculous first infection. Owing to the unobtrusive and temporary nature of its symptoms, it is likely that the tuberculous origin of this illness usually escapes recognition. The detection of a positive skin reaction in a previously tuberculin-negative individual may assist in establishing the tuberculous nature of the symptoms

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#### THE PHYSICAL EXAMINATION AS AN INSTRUMENT OF RESEARCH

In research investigations the United States Public Health Service states, the determination of the physical fitness or condition of a group of persons has proved a difficult problem. No simple solution is to be expected. It is necessary to piece together information from whatever source it can be obtained, with an eye to the precise nature of the investigation itself. All possible means of measuring physical condition must be brought into play—mortality, sickness, and the general physical examination.

Advancement of scientific knowledge rests to a large extent on the improvement of technique. In no field is this more needed than in that of the physical examination. To-day, although technique acquired with much difficulty is employed in making it, no two doctors really follow the same procedure. It must be made clear that the demands of analysis of data collectively are different from the absolutely necessary demands of clinical medicine. The physician, looking for definitely pathological conditions, will probably not fail to note any really serious and practically determinable condition. However, if the results are to be used for statistical purposes, differences in standards of judgment become extremely important, because the minor degrees of impairment are so much in the majority.

Thus the standardization of the physical examination is fundamental in research work. The following principles are suggested:

1. No impairment can be regarded as susceptible of quantitative analysis unless we can be sure that the condition has been looked for in each individual and checked as present or absent.
2. Most impairments encountered in examinations are matters of degree, varying from slight deviations from the normal to very serious conditions. These degrees should be indicated.
3. It is necessary that these degrees mean more or less the same thing to the different examiners. Special intensive training of the examiners is required.
4. Special stress should be placed on the quantitative aspects of the examination, because these can be most effectively analyzed.
5. The examination should be "blind" in so far as practicable; i. e., the examiner should not know whether the individual is or is not exposed to a given hazard under investigation or the degree of his exposure.
6. A thorough history is necessary, because the examination itself gives only a cross-section survey.
7. The presence of acute conditions at the time of the examination must be allowed for.
8. A minimum time should be set for each examination.

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#### AMERICAN SOCIETY OF TROPICAL MEDICINE

The American Society of Tropical Medicine will meet again this year with the Southern Medical Association in Birmingham, Ala., November 16-18, 1932.

In addition to the regular sessions of the society at that time, joint sessions are being arranged with the National Malaria Committee and with the public health section of the Southern Medical Association.



**GRADUATE FORTNIGHT OF THE NEW YORK ACADEMY OF MEDICINE**

Tumors, benign and malignant, will be the theme of the 1932 Graduate Fortnight of the New York Academy of Medicine. The medical profession of the country is invited to participate in the intensive 2-week study of this important medical and surgical subject.

A full program of clinical demonstrations, lectures, and conferences has been arranged to cover all phases of tumors, their diagnoses and treatment.

Concurrent with the fortnight and for an added week thereafter, there will be housed in the academy building an exhibition of anatomical specimens numbering approximately 3,000 units. A number of the sections in the exhibition will be subjected to lecture demonstrations at regular intervals.

Ten evening meetings have been arranged during which tumor growths in various parts of the human anatomy will be discussed. Among the speakers are included Drs. W. Gordon M. Byers, Edwin Beer, Charles A. Elsberg, James Ewing, Donald C. Balfour, Daniel F. Jones, Dean Lewis, Francis Carter Wood, and others.

Thirty afternoon clinical meetings and demonstrations have been arranged in 18 of New York City's leading hospitals, including Bellevue, Lenox Hill, Presbyterian, St. Luke's, Fifth Avenue, Post-Graduate, Neurological Institute, and others.

The fortnight will be held from October 17 to 28, inclusive.

The profession of the country is invited to attend and to participate in the graduate fortnight. There is no charge for attendance at any of the clinics or meetings, but registration is required for participation in the hospital demonstration clinics.

A complete program and registration blank for the clinics and demonstrations may be secured by addressing the New York Academy of Medicine, 2 East One hundred and third Street, New York City.



## BOOK NOTICES

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Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,  
Bureau of Medicine and Surgery, Navy Department,  
Washington, D. C.

(For review)

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**PULMONARY TUBERCULOSIS**, by *Maurice Fishberg, M. D., Chief of the Tuberculosis Service, Montefiore Hospital, New York, and of its Country Sanatorium for Incipient Tuberculosis*. Fourth edition. Vols. I and II. Lea & Febiger, Philadelphia, 1932. Price, \$15

In these two volumes the author has succeeded in bringing together and presenting in a clear and concise manner about all the knowledge of pulmonary tuberculosis available to-day. He has drawn upon the world's literature as well as upon his own vast experience of 30 years in New York City. The books are intended for the general practitioner as well as for the physician who confines his labors to work among the tuberculous in institutions. Both classes will find everything they need for their information in the more than 1,100 pages of these volumes.

The author calls attention to the ubiquity of infection with the tubercle bacillus and the relative infrequency of the disease, phthisis, showing that predisposition plays a larger part in the development of tuberculosis than bacterial infection.

That good economic conditions with high wages and short hours of work are more effective in the reduction of tuberculosis morbidity than all the campaigns being waged by well-meaning but ill-informed organizations is brought out by the author.

A very complete discussion of the nature of infection with the tubercle bacillus and the development of phthisis is given, and considerable space is devoted to showing that an infraclavicular lesion—rather than apical—is generally the start of the active disease.

While the author acknowledges the importance of the X ray as an aid to diagnosis, and states that there are many cases in which no reliable opinion can be given without it, he very properly feels

that unless symptoms of constitutional toxemia are present active pulmonary tuberculosis does not exist.

As to classification, the author does not consider adequate the generally accepted classification of the National Tuberculosis Association, especially for purposes of prognosis, and has devised his own classification, based upon clinical types.

In the second volume a very complete review of the differential diagnosis of phthisis from the diseases which might be mistaken for it, or vice versa, is given, and a most interesting section is devoted to a consideration of the relations between pulmonary tuberculosis and certain physiological and pathological processes, such as growth, puberty, pregnancy, and diseases of other organs.

The chapter on prognosis is complete and enlightening, and the discussion of the diagnosis of disability should prove of real value to naval medical officers who are called upon to decide this question in connection with their veteran patients.

The major portion of the second volume is devoted to a discussion of treatment. All recognized forms of therapy are considered and discussed with an entire absence of prejudice for or against, and the common sense of the author is evidenced by his acknowledgment of the sufficiency of good air, good food, and good residence as curative measures in the vast majority of cases. Special measures, such as the use of tuberculin, therapeutic pneumothorax, phrenic exeresis, and thoracoplasty, should be reserved for the exceptional case. Even then, except for artificial pneumothorax, such procedures are usually useless, because by the time the patient has arrived at the stage where he needs them it is too late for them to accomplish much.

The only fault the reviewer can find with these volumes, and this is a minor one, is that they show evidence of hurried or careless proofreading. This should not be in a work which is otherwise so satisfactory.

**PRINCIPLES OF PREOPERATIVE AND POSTOPERATIVE TREATMENT**, by *Reginald Ales Cutting, M. D., C. M., M. A., Ph. D., Assistant Professor of Surgery, Tulane University Medical Center; formerly Assistant Professor of Surgery, Tulane University Medical School, New Orleans.* Foreword by *Rudolph Matas.* Paul B. Hoeber (Inc.), New York, 1932

The contents of this book appeared in serial form in the *American Journal of Surgery*. It is volume 2 of Hoeber's *Surgical Monographs* and a companion volume to *Livingston's Abdominal Cavity and Peritoneum*, recently reviewed in the *BULLETIN*.

The matter is well chosen and the ideas clearly expressed. Not the least readable part of the book is the foreword, by *Rudolph Matas*, in which he describes the gradual development of our modern realization of the importance of treatment before and after operation.

In addition to a discussion of the general principles underlying rational preoperative and postoperative treatment, there are chapters on shock and collapse; blood transfusion; water balance, dehydration and the administration of fluids; disturbances of acid-base equilibrium, acidosis and alkalosis; abdominal distention and gas pains; dilatation of the stomach; urinary disturbances; postoperative pulmonary complications; treatment of operative wounds; postoperative peritonitis; thrombophlebitis; care of patients with prostatic hypertrophy; surgical diabetic patients; gall-bladder cases; patients with toxic goiter; gastric cases; treatment of extensive superficial burns; acute traumatic craniocerebral injuries and intestinal obstructions.

It is recommended as a most valuable book, one to be kept on the desk close at hand, for it is worthy of daily consultation by the busy surgeon.

**ELECTROSURGERY**, by *Howard A. Kelly, M. D., LL. D., F. A. C. S., and Grant E. Ward, M. D., F. A. C. S., Baltimore, Md.* W. B. Saunders Co., Philadelphia, 1932.

There are few branches of surgical science which have spread so rapidly or received such close study from important men as has electrosurgery. There is hardly a surgical field in which it has not been tried and found useful.

Since it has not yet been found feasible to provide radium for our naval hospitals, a knowledge of electrosurgery is doubly important for surgeons in the Navy if we are to keep pace with civilian institutions. None of us can afford to ignore the great advances in this field.

The present volume is the most practical, complete, and reliable manual on the subject that has appeared during the last few years. The prestige and experience of the senior author, with the experimental studies of the energetic junior, have united to produce a most creditable work.

Introductory chapters are devoted to the history; physics of high-frequency currents; histological studies and the general principles involved. These are followed by chapters on lesions of the skin; oral cavity; otolaryngology; thyroid; thorax, by T. G. Aycock; breast; abdomen; gynecology; urology, by Hugh H. Young; proctology; central nervous system; irradiation and electrosurgery.

**HUMAN CANCER**, by *Arthur Purdy Stout, M. D., Associate Professor of Surgery, College of Physicians and Surgeons, Columbia University; etc.* Lea & Febiger, Philadelphia, 1932. Price, \$10.

A very excellent treatise, which covers the entire subject of malignancy as completely as can be done in one volume.

Cancer of each particular anatomical region of the body is discussed from the following standpoints: Etiological factors and precancerous lesions; the beginning, growth, and spread of the cancer; the symptoms and signs; and the principles of treatment of the part involved.

There are numerous fine and original illustrations of both gross and microscopical specimens. One of the outstanding features is the extensive bibliography at the end of each chapter.

The author, drawing from his own experience as well as that of numerous associates, has produced a book worthy of praise and of value to the profession.

**PRACTICAL TREATMENT OF SKIN DISEASES**, by *Eduard Ahlswede, M. D.*, *New York and Hamburg; formerly Assistant Physician, University Skin Department, Direction of Professor Unna, Eppendorf Hospital, Hamburg; etc.* Paul B. Hoeber (Inc.), New York, 1932. Price, \$12.

Just what its title claims, this is a volume on the practical therapy of skin diseases.

The subject is presented in a clear and concise style, and is divided into two parts.

In Part I there is a discussion of the general considerations, general management, and the technique of treatment of skin diseases.

In Part II the individual skin diseases, with their treatment, are dealt with in alphabetical order.

As Doctor Ahlswede, the author of this book, was a pupil of Professor Unna, naturally many of the methods of treatment and the remedies given are of the "Unna school," although a number of English, French, and American authors are quoted.

The work is thoroughly practical, and as a ready reference book for the busy practitioner it will be found of value.

**RECENT ADVANCES IN PATHOLOGY**, by *Geoffrey Hadfield, M. D., F. R. C. P.* (*Lond.*), *Professor of Pathology in the University of London, Pathologist to the Royal Free Hospital, and Lawrence P. Garrod, M. A., M. B., B. Ch.* (*Camb.*), *M. R. C. P. (Lond.) Bacteriologist and Lecturer in Bacteriology, etc.* P. Blakiston's Son & Company (Inc.), Philadelphia, 1932. Price, \$3.50

This volume treats of the recent advances in the following subjects: The reticulo-endothelial system, tissue culture, experimental cancer research, deficiency diseases, hypervitaminosis, calcium metabolism, endocarditis, diseases of the arteries, pneumonia, primary carcinoma of lung, pneumoconioses, anoxemia, peptic ulcer, necrosis of the liver, Bright's disease, neuroglia and glioma group of tumors, encephalitis, thyroid, parathyroids, and adrenals.

In the selection of the material and in the fullness of its treatment, the authors state:

We have been guided by three considerations—the intrinsic importance of the subject, the extent of its illumination by recent work, and the availability

of such new information in other literature. Nephritis and pneumonia call for extended treatment, rather for their importance as diseases than for any striking discovery about them; nephrosis and parathyroid adenoma, notwithstanding their comparative rarity, for the interest they derive from recent investigations and for the bearing of these investigations on every-day problems. The devotion for a large amount of space to experimental cancer research is explained not only by the magnitude of the subject but by the fact that no equivalent general account of modern work in this field is available elsewhere.

For those who desire to read in greater detail, an extensive list of references is given at the end of each chapter.

**MINOR SURGERY OF THE URINARY TRACT**, by *Hermon O. Bumpus, jr., Ph. B., M. D., M. S. in Urology, F. A. C. S., Section on Urology, the Mayo Clinic, etc.*, with a chapter on **CARCINOMAS**, by *John L. Crenshaw, M. D., Section on Urology, the Mayo Clinic, etc.*, and a chapter on **POSTOPERATIVE CARE**, by *Anson L. Clark, M. B., M. D., Section on Urology, the Mayo Clinic, Rochester, Minn.* W. B. Saunders Co., Philadelphia, 1932

A small monograph on minor surgery of the urinary tract prepared by an author whose experience in this field well qualifies him to evaluate the various methods employed with transurethral surgery.

The various technical procedures involved, all of which the author has been active in developing to a high degree of efficiency, particularly that of transurethral resection of the prostate gland, are clearly and concisely described.

The book will be of interest and value to medical officers specializing in urology.

**AN EXPERIMENTAL AND CLINICAL STUDY OF PAIN IN THE PLEURA, PERICARDIUM, AND PERITONEUM**, by *Joseph A. Capps, M. D., Professor of Clinical Medicine, University of Chicago.* The Macmillan Co., New York, 1932

This small volume presents the results of an experimental and clinical study of pain in the pleura, pericardium, and peritoneum carried out over a period of 20 years.

It is an original and important contribution to the study of pain phenomena in the viscera.

**MEDICINE AMONG THE AMERICAN INDIANS**, by *Eric Stone, M. D., Providence, R. I.* Paul B. Hoeber (Inc.), New York, 1932. Price, \$1.50.

This comprises Volume VII of the *Clio Medica* Series which was inaugurated by Dawson's "The Beginnings: Egypt and Assyria," and which is edited by E. B. Krumbhaar, the widely known medical historian. The author has assembled, in this interesting little volume, the heretofore widely scattered material relating to the medical practices of the American Indians.

**OBSTETRICS**, by *J. Whitridge Williams, Professor of Obstetrics, Johns Hopkins University; Obstetrician in Chief to the Johns Hopkins Hospital, Baltimore.* Sixth edition. D. Appleton & Co., New York, 1931.

This work has been a standard textbook of obstetrics for so many years and is so well known to naval medical officers that an extensive review is unnecessary.

It is sufficient to say that the present edition has been thoroughly revised and lives up to the same high standard which has characterized the previous editions.

**DISEASES OF THE CORONARY ARTERIES (MYOCARDITIS)**, by *Don. C. Sutton, M. S., M. D., Associate Professor of Medicine, Northwestern University, etc., and Harold Lueth, Ph. D., M. D., formerly Instructor Physiology, Northwestern University, Chicago.* The C. V. Mosby Co., St. Louis, 1932. Price, \$5.

The authors of this volume show by the text that they have given considerable time and study to the subject of diseases of the coronary arteries (myocarditis).

They give in clear and concise style the symptomatology, physical examination, anatomy, pathology, physiology, and treatment of diseases of these vessels.

The text consists of 152 pages, supplemented by 45 instructive illustrations.

An extensive list of references is appended.

**MATERIA MEDICA, PHARMACOLOGY, THERAPEUTICS, AND PRESCRIPTION WRITING**, by *Walter A. Bastedo, Ph. G., M. D., Sc. D. (Hon. Columbia), F. A. C. P., Assistant Clinical Professor of Medicine, Columbia University; Consulting Physician, St. Luke's Hospital, New York, etc.* Third edition. W. B. Saunders Co., Philadelphia, 1932.

This new edition appears after a hiatus of about 10 years, during which time there has been a number of essential advances made in this field.

Referring to this revision in the preface, Doctor Bastedo states:

Extensive recent research in physics, chemistry, physiology, pharmacology, bacteriology, experimental therapeutics, and clinical medicine and surgery have made necessary an almost complete rewriting. New articles have been added on suprarenal cortex, ephedrine, quinidine, plasmochin, yatren, ethylene, the barbiturates, preanesthetic narcotics, carbon dioxide, carbon tetrachloride, the antiseptic dyes, mercurochrome, metaphen, the mercury diuretics, phenylhydrazine, insulin, ovarian preparations, colloidal lead in cancer, and a number of other remedies that have attained therapeutic interest. Special articles have been introduced on alkalis in stomach treatment, alkali substitutes in stomach treatment, and the effect of atropine on the stomach. The endocrine drugs have not been considered as a class, but have been introduced where they seemed to belong, pharmacologically or therapeutically.



This new edition by an established authority will prove a valuable asset as a textbook or ready-reference book.

**MODERN GENERAL ANESTHESIA**, by James G. Poe, M. D., *Lecturer on General Anesthesia in the Medical and Dental Departments of Baylor University, etc.* Second edition. F. A. Davis Co., Philadelphia, 1932. Price, \$2.50.

This small handbook, intended primarily for the student, gives in a clear and concise manner the essentials of general anesthesia.

It contains a wealth of practical information in regard to the administration of ether, nitrous oxide, ethylene, chloroform, and ethyl chloride.

A brief discussion is also given of the nonvolatile anesthetics, such as avertin, sodium amytal, and the various methods of local anesthesia.

**LABORATORY TECHNIQUE**, by R. B. H. Gradwohl, M. D., *Director, Gradwohl School of Laboratory Technique; Pathologist to the Coroner of the City of St. Louis; Lieutenant Commander, Medical Corps, Fleet—United States Naval Reserve.* Publishers, Gradwohl School of Laboratory Technique, 3514 Lucas Avenue, St. Louis, Mo., 1932. Price, \$8.

Doctor Gradwohl, with the assistance of his collaborators, has produced a very practical working manual of clinical laboratory methods.

In the selection and the style of presenting the material, the work reflects the 30 years' experience in this field by the senior author, which includes teaching the subject in the Gradwohl School of Laboratory Technique.

The scope of the book is well shown by the chapter headings, namely, clinical pathology, parasitology and exotic pathology, hematology, blood chemistry, urine chemistry, toxicological technique, bacteriology, serology, basal metabolism, photomicrography, electrocardiology, and mycology.

A section on laboratory equipment has been included, and illustrations of the more common microscopical subjects have been grouped together at the back of the book.

This manual will prove a valuable guidebook for those engaged in laboratory work.

**MANUAL OF CLINICAL AND LABORATORY TECHNIC**, by Hiram B. Weiss, A. B., M. D., F. A. C. P., *Associate Professor of Medicine, College of Medicine, University of Cincinnati, Cincinnati, Ohio, and Raphael Isaacs, A. M., M. D., F. A. C. P., Associate Professor of Medicine, Assistant Director of the Thomas Henry Simpson Memorial Institute for Medical Research, University of Michigan, Ann Arbor, Mich.* Fourth edition. W. B. Saunders Co., Philadelphia, 1932.

This small manual of 117 pages gives in a very condensed and systematic manner a wealth of useful information concerning history

taking, physical examination, laboratory examinations, technical laboratory procedures, and nutritive food values.

The book is intended as a guide for the student or interne to follow in the systematic study of patients and as a handy reference book for the practitioner.

**MEDICAL FORMULARY**, by *E. Quin Thornton, M. D., Assistant Professor of Materia Medica in the Jefferson Medical College, Philadelphia.* Thirteenth edition. Lea & Febiger, Philadelphia, 1932. Price, \$2.50.

This revision of Thornton's well-known *Formulary* has been made necessary by reason of new remedies that have come into general use since the appearance of the twelfth edition in 1925.

Among these new remedies of real worth may be mentioned liver extract, ventriculin, viosterol, and hexylresorcinol S. T. 37.

Also given consideration in this revision are some of the older remedies that have assumed new importance, such as sodium thio-sulphate in connection with the administration of arsenical compounds and the use of whole blood in measles and poliomyelitis.

Throughout the text only formulæ which have proved of value in the practice of the author or of others have been included, and new appropriate formulæ to meet the developments in hypodermic and intravenous medication have been added.

The book serves a useful purpose in that it enables physicians to prescribe pharmacopeal drugs in palatable form, thus diminishing the use of proprietary and patent remedies which are so often prescribed because the patient finds them easy to take.

**THE PRINCIPAL NERVOUS PATHWAYS**, by *Andrew Theodore Rasmussen, Ph. D., Professor of Neurology, Department of Anatomy, University of Minnesota, Medical School, Minneapolis, Minnesota.* The Macmillan Co., New York, 1932

In this small monograph of 73 pages the more important nervous pathways in the central nervous system and their relations to the peripheral nerves are presented in the form of charts and graphs which are supplemented, where necessary, by a concise, explanatory text.

It is admirably adapted for the use of the student studying neuro-anatomy.

**PATHOLOGY FOR NURSES**, by *Eugene C. Plette, M. D., Pathologist and Director of the Clinical Laboratories of the West Suburban Hospital, Oak Park, Ill., Consultant Pathologist, Chicago State Hospital.* F. A. Davis Co., Philadelphia, 1932. Price \$2.50

A book written for the nurse in training. The subject is limited to the important cardinal problems of pathology, which the author presents in an unusually interesting manner.

As an aid to the student a summary and a list of questions is given at the end of each chapter.

The illustrations are numerous and appropriate for the purpose for which the book is intended.

**THE MEDICAL CLINICS OF NORTH AMERICA, MARCH, 1932.** W. B. Saunders Co., Philadelphia, 1932

This number contains contributions from the leading clinics in New York.

The first paper is by Dr. Herman O. Mosenthal, who discusses the clinical aspects of Bright's disease; chronic diffuse glomerular nephritis.

Five cases are presented, and the subject is discussed from the following standpoints: Anatomical diagnosis—pathologist's classification of Bright's disease; clinical diagnosis—physician's classification of Bright's disease; treatment of the existing conditions; and preventive treatment: prognosis and clinical course.

In summarizing, Doctor Mosenthal states:

I hope that it has been made clear that the treatment of Bright's disease is made easier for the physician and more effective for the patient if the classification of this group of conditions is made in part on the usual anatomical basis, but that it is not considered complete until the functional changes have been investigated as well. Bright's disease considered in this way would be thought of as comprising six factors, phases, or problems, which to a certain extent overlap one another, but still deserve individual consideration if the diagnosis, therapy, and prognosis of each case are to receive adequate attention. These are: (1) Pathology of the kidney (i. e., nephritis) and other organs; (2) renal function; (3) edema; (4) blood pressure; (5) anemia; (6) uremia. Each one of these factors in Bright's disease constitutes a pathologic disturbance in itself which has various types and groupings of morbid entities concerned in it. These are all brought to the fore and made evident to the physician if this classification of Bright's disease is followed through conscientiously. Not only is the existing condition given adequate attention but through this classification a conception of the possibilities of development of the signs and symptoms that may occur during the clinical course of the disease will be made evident and preventive treatment is made much more effective.

Dr. E. D. Friedman has contributed an interesting paper on the clinical and pathological considerations in epidemic poliomyelitis.

The other papers cover a wide variety of topics, including hemoglobinuria in childhood, pyloric and duodenal stenosis, polycystic kidneys, dementia præcox, pernicious anemia, rheumatic fever in childhood, and various phases of cardiac disease.

**THE MEDICAL CLINICS OF NORTH AMERICA, MAY, 1932.** W. B. Saunders Co., Philadelphia, 1932

This, a Mayo Clinic number of the Medical Clinics, contains 22 articles by the staff of the Mayo Clinic and the Mayo Foundation for

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Medical Education and Research, Graduate School, University of Minnesota.

The first paper is by Walter C. Alvarez on "Patients who are incapacitated by a little indigestion." A number of cases are cited in which a more careful history and physical examination showed the abdominal symptoms due to some mental or nervous disorder.

He states:

One of the sad features of medical education to-day is that students in universities rarely see cases of this type. Every day they are taught to turn to the röntgenologic and clinical laboratories for help in diagnosing definite organic disease in the abdomen, and as a result, when they graduate, it seldom seems to occur to them that the patient who complains of indigestion may have absolutely nothing wrong in the abdomen. When all the laboratory reports are negative they still want to operate because they feel so sure that something will be found.

Actually, they should be taught in college that when they get out into practice many of the persons whom they will see with indigestion will be suffering primarily from some defect in, or injury to, the nervous system. One of the finest things that they can learn to do in this world is to teach these patients to stop looking for a "cure" and instead to accustom themselves to living as best they can with a handicap. Often the finding of a simpler job in a quieter place, the development of better habits of mental hygiene, the getting of more rest, the giving up of some ambitions, and, above all, the getting of a better understanding of the problem are greater curative value than a barrel of medicine and a dozen operations. Above all, medical students must be taught to have great sympathy for these poor persons. Often when I learn the facts about the family history, instead of being contemptuous of the patient I feel like congratulating him on what he had been able to accomplish in life.

Philip W. Brown discusses several cases with inflammatory lesions of the colon simulating carcinoma.

Walter R. Johnson has contributed a paper on the "differential diagnosis of cases of jaundice without pain."

B. R. Kirklin has an article on "Common inflammatory diseases of the lungs as depicted by the Röntgen ray."

Albert M. Snell reports two cases of chronic steatorrhea with tetany.

A wide variety of other conditions are discussed with report of cases.

THE SURGICAL CLINICS OF NORTH AMERICA, APRIL, 1932. W. B. Saunders Co., Philadelphia, 1932

This is a New York number of the Surgical Clinics, and, as is always the case with these books, this number contains reports and discussions of many interesting cases.

Dr. John F. Erdmann gives a practical discussion of the preoperative and postoperative care of patients.

Dr. J. M. Hitzrot contributes a paper on fractures at the lower end of the humerus in adults.

Dr. R. T. Frank discusses the clinical application of biological endocrine tests.

In addition to these and the usual papers discussing many problems of surgical practice, this number contains a symposium on the liver and gall bladder, a symposium on diseases of the thyroid, and a symposium on diseases of the breast, all from the Surgical Service of Dr. C. G. Heyd, New York Postgraduate Medical School, Columbia University. These clinics were held for the Clinical Congress of the American College of Surgeons.

THE SURGICAL CLINICS OF NORTH AMERICA, JUNE, 1932. W. B. Saunders Co., Philadelphia, 1932

A Lahey Clinic number of the Surgical Clinics containing 35 papers discussing various problems in general surgery, anesthesia, gastro-enterology, orthopedics, urology, and otolaryngology.

Dr. Frank H. Lahey contributes three papers—"The present management of biliary tract disease," "Carcinoma of thyroid arising in discrete adenomata," and "Operative injury to the recurrent laryngeal nerve."

Dr. Howard M. Clute writes on "The surgical management of obstructive jaundice," "Obstructive jaundice due to stricture of the common duct," "Resection of stomach in two stages," and "Urinary incontinence in women."

Dr. Lincoln F. Sise discusses "Preoperative narcosis," "The control of blood pressure in spinal anesthesia," and "Postoperative pulmonary complications. A comparison of the effect of spinal and of ether anesthesia."

Among the other interesting papers are "Sedimentation rate in obstructive jaundice," by Drs. H. M. Clute and J. R. Veal; "Carbon dioxide absorption method of gas anesthesia," by Dr. P. D. Woodbridge; "Blood transfusion reactions," by Dr. C. L. Wilson; "Treatment of severe contractures of calf muscles," by Dr. G. E. Haggard; and "Dysphagia," by Dr. W. B. Hoover.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by Mrs. Maud H. Mellish-Wilson and Richard M. Hewitt, B. A., M. A., M. D. Volume XXIII, 1931. W. B. Saunders Co., Philadelphia, 1932

As there are nearly 200 papers on a great variety of subjects in this volume, it is impossible to attempt a review of its contents. As in previous volumes, the material has been selected from papers written by members of the staffs of the Mayo Clinic and the Mayo Foundation.

The papers are grouped under the following headings: Alimentary tract; genito-urinary organs; ductless glands; blood and circu-

latory organs; skin and syphilis; head, trunk, and extremities; chest; brain, spinal cord, and nerves; technic; and miscellaneous.

Many of the articles are abridged or abstracted, and at the end of each subject group there is a list of papers by title and reference.

PLASTIC SURGERY OF THE NOSE, EAR, AND FACE, by *Dr. Victor Fruhwald, ex-assistant of the Nose, Throat, and Ear Clinic in Vienna*. Translated by *Geoffrey Morey, M. B., B. S. (Adelaide), D. L. O. (London), Junior Surgeon, Shropshire Nose, Ear, and Eye Hospital, Shrewsbury*. Wilhelm Maudrich, Vienna, 1932

A primer with hardly enough detail to be of value to the beginner.

## THE DIVISION OF PREVENTIVE MEDICINE

O. J. MINK, Captain, Medical Corps, United States Navy, in charge

### TOXIC EFFECTS OF ARSENICAL COMPOUNDS EMPLOYED IN THE TREATMENT OF SYPHILIS IN THE UNITED STATES NAVY—1930

By O. J. MINK, Captain, Medical Corps, United States Navy, and A. C. GELATTE, Chief Pharmacist's Mate, United States Navy

Since November, 1924, medical officers of the Navy have been required to make monthly reports of the numbers of doses of arsphenamine and neoarsphenamine, etc., administered. A separate account of every case in which ill effects are noted is also required.

Previous articles dealing with the information obtained from these reports were published in the September, 1925, January, 1927, January, 1929, July, 1930, and October, 1931, numbers of the UNITED STATES NAVAL MEDICAL BULLETIN and covered the subject up to and including the calendar year 1929. The present article supplements these and is in the interest of continuous published statistical information relative to the ill effects experienced from the administration of arsenicals in the United States Navy. This installment takes into consideration the doses of arsenical compounds administered in the treatment of syphilis during the calendar year 1930 and includes some comparative figures from the experience of previous years.

It is the desired intention to present the Navy's arsenical experience by years, and we have endeavored to continue the classification of reactions in the manner adopted by Commander J. R. Phelps, Medical Corps, United States Navy, in his fourth contribution, which appears in "The Division of Preventive Medicine" section of the NAVAL MEDICAL BULLETIN of July, 1930.

The "reactions" or ill effects encountered during the calendar year 1930 are as follows:

Encephalitis hemorrhagica.....	0
Vasomotor phenomena (shocklike, nitritoid, anaphylactoid, etc.).....	58
Exfoliative dermatitis and its complications.....	13
Acute yellow atrophy of the liver.....	0
Jaundice.....	2
Acute renal damage.....	0
Ulcerative enteritis.....	0
Polyneuritis.....	0
Aplastic anemia.....	2

Herxheimer reactions.....	0
Jarisch-Herxheimer.....	2
Reactions of minor importance, including those in which there were insufficient data for classification.....	6
Total.....	83

The following table shows the number of treatments with the various arsenical compounds administered by naval medical officers in the treatment of syphilis during the 5-year period 1925-1929, the calendar year 1930, and the totals for the six years 1925-1930, with the number and ratio of fatal and nonfatal toxic effects and of deaths to the number of doses administered:

	Number of doses administered	Mild reactions	Severe reactions	Fatal reactions	Total reactions	Ratio of reactions to doses—1 reaction to—	Ratio of deaths to doses—1 death to—
<b>5-year period, 1925-1929:</b>							
Arsphenamine.....	27,643	25	13	1	39	709	27,643
Neosarsphenamine.....	314,224	174	64	19	257	1,223	16,538
Sulpharsphenamine.....	6,542	3	2	0	5	1,308	0
Tryparsamide.....	9,380	1	0	0	1	9,380	0
Miscellaneous.....	58	0	0	0	0	0	0
Total.....	357,847	203	79	20	302	1,185	17,892
<b>1930:</b>							
Arsphenamine.....	1,393	0	0	0	0	0	0
Neosarsphenamine.....	85,646	61	18	3	82	1,044	28,549
Sulpharsphenamine.....	1,421	0	1	0	1	1,421	0
Tryparsamide.....	4,418	0	0	0	0	0	0
Total.....	92,878	61	19	3	83	1,119	30,959
<b>6-year period, 1925-1930:</b>							
Arsphenamine.....	29,036	25	13	1	39	745	29,036
Neosarsphenamine.....	399,870	235	82	22	339	1,180	18,178
Sulpharsphenamine.....	7,963	3	3	0	6	1,327	0
Tryparsamide.....	13,798	1	0	0	1	13,798	0
Miscellaneous.....	58	0	0	0	0	0	0
Total.....	450,725	264	98	23	385	1,171	19,597

Referring to the above table, the ratios of reactions and deaths to doses administered for 1930 are: Reactions, 1 to 1,119, and deaths, 1 to 30,959. The averages for the 5-year period 1925-1929 are: Reactions, 1 to 1,185, and deaths, 1 to 17,892; and for the 6-year period 1925-1930—reactions, 1 to 1,171, and deaths, 1 to 19,597.

Deaths charged to the administration of arsenical compounds in the treatment of syphilis during the past 12 years were recorded as follows:

Year	Arsphenamine	Neosarsphenamine	Kind not specified	Total	Year	Arsphenamine	Neosarsphenamine	Kind not specified	Total
1919.....	2	0	1	3	1926.....	0	4	0	4
1920.....	1	1	0	2	1927.....	1	4	0	5
1921.....	3	1	0	4	1928.....	0	6	0	6
1922.....	0	4	0	4	1929.....	0	3	0	3
1923.....	0	1	0	1	1930.....	0	3	0	3
1924.....	1	2	0	3					
1925.....	0	2	0	2	Total.....	8	31	1	40



Supplementing Table 4 of the July, 1930, and October, 1931, articles, the three deaths which occurred in 1930 are as follows:

Immediate cause of death	Arsphen-amine	Neoarsphen-amine
Previously listed.....	8	28
Vasomotor phenomena:		
<i>Immediate shock.</i> —Precipitating an acute suppurative pancreatitis resulting in death 20 days and 17 hours after third dose of sixth (?) course. (Had received 30 plus doses since June, 1927).....	0	1
<i>Delayed shock.</i> —Precipitating an acute exacerbation of pulmonary tuberculosis, chronic, fibroid, complicated by bronchopneumonia, cardiac dilatation, etc., resulting in death about 2 hours after third dose of fifth course. (Had received 36 doses since Nov. 4, 1925).....	0	1
Aplastic anemia:		
Death occurred 16 days after fourth dose of second course. (Had received 12 doses since Nov. 7, 1929).....	0	1
Total.....	8	31

During the 6-year period 1925–1930 there were 13.77 times more neoarsphenamine than arsphenamine injections administered. Many factors must be considered in an attempt to determine the advantages or disadvantages of arsphenamine as opposed to neoarsphenamine, and sufficient data for a comprehensive comparison are not available. However, the following figures from the Navy's experience with 29,036 doses of arsphenamine and 399,870 doses of neoarsphenamine are of interest, because they may show a possible reaction expectancy regardless of whether the ill effects are due to the drug, technique, idiosyncrasy, or some other cause.

Total number of doses arsphenamine.....	29,036
Total reactions arsphenamine.....	39
Total number of doses neoarsphenamine.....	399,870
Total reactions neoarsphenamine.....	839
Possible number of reactions from arsphenamine as compared with the number of doses of neoarsphenamine administered.....	537
Possible ratio of arsphenamine reactions to neoarsphenamine reactions (using the possible figure 537).....	1.58 to 1
Possible ratio of neoarsphenamine reactions to arsphenamine reactions (using the same possible figure as above).....	0.63 to 1

#### HEMORRHAGIC ENCEPHALITIS

No cases of hemorrhagic encephalitis chargeable to the effects of arsenicals occurred during the year 1930.

*Cases suggesting border-line relationship between acute hemorrhagic encephalitis and the other forms of acute poisoning by arsenical compounds used in the treatment of syphilis.*—During the year 1930 no reactions occurred which would seem to fall under this heading.

*Proportion of deaths from hemorrhagic encephalitis to the number of patients treated for syphilis and to numbers of doses of arsenical*

*compounds administered.*—We do not know the actual number of different individuals treated for syphilis. Every year a number of men are treated who began treatment several years before, and these are not necessarily readmitted to the sick list. This information, however, is included in the annual section of the new Form A to be used beginning December, 1931, and will be available for compiling arsenical statistics in later years.

We do know the total numbers of doses of the several arsenical compounds administered. During the year 1930 there were 1,139 doses of arsphenamine and 85,646 doses of neoarsphenamine administered with no deaths due to hemorrhagic encephalitis. During the 6-year period 1925–1930 there were 29,036 doses of arsphenamine administered, with 1 death due to hemorrhagic encephalitis; there were 399,870 doses of neoarsphenamine administered during the same period, resulting in 10 deaths from hemorrhagic encephalitis, giving a ratio of 1 death to 39,987 doses administered.

During this period of six years, 7,963 doses of sulpharsphenamine and 18,798 doses of tryparsamide were administered, with no deaths from any cause referable to the arsenical compound.

#### VASOMOTOR PHENOMENA

In previous articles on this subject covering the years up to and including the year 1929, 110 cases reported by medical officers have been grouped as examples of vasomotor phenomena following the intravenous injection of neoarsphenamine or other arsenical compounds. Of the 58 cases reported in 1930 to be grouped under this heading, 53 were mild reactions, 3 were severe, and 2 resulted in death.

*Deaths.*—The two reactions of this type which resulted in death in 1930 followed the intravenous use of neoarsphenamine. As stated previously, the ratio of death to *cases* treated is not known. The ratio of deaths (vasomotor phenomena) to the number of *doses* of neoarsphenamine administered for 1930 was 1 death to 42,823 doses. Including the above two fatal cases, the four deaths due to vasomotor phenomena which have occurred during the 6-year period 1925–1930 give a ratio of 1 death to 99,968 doses of neoarsphenamine. No deaths (vasomotor phenomena) occurred from 29,036 doses of arsphenamine.

*Fatal cases—(Case histories).*—A patient, private in the United States Marine Corps, at the time of his death on September 10, 1930, was 29 years and 8 months of age. He was first admitted for syphilis June 12, 1927, while serving in Shanghai, China, at which time he presented an initial lesion, and on June 22, 1927, his serum reaction was (Kahn) 4 plus. From June 28 to August 16, 1927, he

received eight injections of neoarsphenamine, amounting to 5.85 grams. On June 14, 1928, serum reaction was doubtful, and on June 21 it was 1 plus. From July 7 to October 16, 1928, he received eight injections—amount, arsenical compound, and dosage not stated. October 31 and November 7, 1928, the serum reaction was 3 plus. November 10 to November 24, 1928, he received three injections—amount, arsenical compound, and dosage not stated. On December 26, 1928, the serum reaction was 4 plus. From January 2 to January 23, 1929, he received ten injections of 1 gram each of sodium thiosulphate intravenously. The reason for this treatment or why the preceding course was stopped after the third injection is not stated. On February 12 and March 5, 1929, the serum reactions were 4 plus. Following the arsenical treatment which ended November 24, 1928, no treatment with arsenic preparations is recorded until August 8, 1930, though a course or part of a course must have been given, as evidenced by a recorded arsenical reaction, as follows: On March 31, 1929, the patient was admitted with a diagnosis of purpura simplex. The record states that 24 hours following an injection of neoarsphenamine the man had small petechial areas over volar surface of both forearms, that small purpuric spots appeared over both legs, and a large hemorrhagic spot on bruised place under left eye. Temperature was recorded as normal; bleeding time, 14 minutes; coagulation time, 9 minutes and 20 seconds; red blood count, 4,830,000; white blood count, 7,700; hemoglobin, 90 per cent; polymorphonuclears, 76 per cent; lymphocytes, 22 per cent; and urine negative—some leukocytes. The recording medical officer states that this appeared to be a toxic purpura, following arsenicals. April 5, 1929, the patient was sent to duty under treatment. Following this the record shows no further antisyphilitic treatment until August 8, 1930. November 26, 1929, and July 17, 1930, the serum reactions were 2 plus. From August 8 to August 20, 1930, three injections of neoarsphenamine, 0.3, 0.6, and 0.4 gram, respectively, were given, the third of which brought on the reaction that occurred 20 days and 17 hours prior to his death. Pancreatitis, acute, was entered on the report of death as the primary cause of death and poisoning, acute, neoarsphenamine (antisyphilitic), the contributory cause.

For statistical purposes the primary cause of death in this case is carried as syphilis and the contributory cause as above. At 10.15 a. m. on August 20, 1930, the patient was given 0.4 gram of neoarsphenamine, the third dose of the current course; 0.6 gram was in the syringe; at 0.4 gram he complained of sickness and pain in the stomach. While on the table he noted a pricking sensation on the face, which rapidly covered his entire body. Patient vomited, in-

cluding bananas in remains of breakfast. He rapidly became acutely ill, face flushed, and he complained of severe and general pain, nausea, and vomiting. Pulse became weaker, rapid, and later barely perceptible. His limbs were cold and there was a tendency to cyanosis. Several bowel movements occurred about two hours after receiving injection. Two and one-half hours after receiving injection his condition was improved, and he then transferred to a naval hospital. Patient vomited everything he took for about three days. There was tenderness, muscular spasm, and rigidity over epigastrium. While conscious he desired to be let alone and wanted to sleep. August 21 urine showed glucose and acetone and there was an acetone odor to breath. Blood sugar, 323 mg. August 23 the urine was still positive for acetone and the blood sugar was 245 mg. Van den Bergh direct—delayed—quantitative 3 mg. Icterus index 35. Faint yellowing of conjunctivæ. August 26 the urine was still positive for acetone and the blood sugar was 240. August 28 the acetone odor of breath disappeared. September 4 blood sugar was 369. Urine positive for acetone and diacetic acid. September 8 patient began vomiting again and was unable to eat. At this time 24-hour urine specimen was negative for sugar; blood sugar was 333 mg. There was pain in upper abdomen and there was tenderness in right upper quadrant. A mass was palpable in this area. White blood count, 36,400; polymorphonuclears, 89; lymphocytes, 11. Temperature was 97.3. On September 9 marked evidence of acidosis. Liver apparently enlarged and extending two finger breadths below costal margin. Great thirst; but he could not retain water. About 6 p. m. he began to vomit almost continuously and the vomitus became fecal in character; the skin was cold and dry; when pinched appearance that the tissues were dehydrated. One drop of urine completely reduced 5 cc of Benedict's qualitative sugar solution. September 10 at 3 a. m. he became restless, and at 5 a. m. respiration became shallow and rapid; the radial, carotid, or temporal pulse were not obtainable, although the heart continued to beat weakly. Patient died at 5.20 a. m., September 10.

Autopsy findings in this case were acute pancreatitis with abscess formation; widespread fat necrosis in the lesser peritoneal cavity in the omentum mesentery of the small and large intestine and retroperitoneally down as far as the pelvis; congestion and cloudy swelling of liver and kidneys; hypostatic congestion of lungs; and atherosclerosis of the aorta. Treatment in this case consisted of intravenous 1-gram doses of sodium thiosulphate, Murphy drip, intravenous saline, intravenous glucose, insulin, and high caloric diet, etc. The course of three injections, which began August 8 and ended August 20, 1930, clearly determined the illness which resulted in death. That a definite point of complete intolerance had been

reached is evident, and some of the autopsy findings are in accord with neoarsphenamine poisoning superimposed on the pathology of syphilis and a suppurative pancreatitis. It is not impossible that the development of pancreatic pathology was favored by and an indirect outcome of the slowly accumulating pathology of arsenical poisoning, but this observation can be regarded as nothing more than a conjecture. Certainly, acute suppurative pancreatitis is not known to be directly connected, as sequelæ, with the effects of arsenical medication. At best the aspects of the case are involved, and the symptoms of acute suppurative pancreatitis were prominent in the picture. No statement of dosage is made in any of the courses of treatment subsequent to the series of eight injections ending February 18, 1928 (except the last course, August 8 to August 20, 1930). The 16 injections up to that time were in amounts exceeding the later (1929) advised limit of 0.6 gram. The case had received repeated courses of neoarsphenamine treatment beginning June, 1927, totaling 31 (plus) injections in all. Record of 47 mentioned in the death report can not be found, and the statement that there had been no previous reaction is in error. It is true that there had been no untoward reaction until March 31, 1929, following what was the twenty-seventh injection, the day before. The reaction at that time was a pupura, regarded as toxic, appearing 24 hours after the injection. The amount of this injection and whether or not preceded by other injections does not appear in the record. The occurrence undoubtedly indicated a beginning sensitized condition. Such reactions, symptomatic of intolerance, constitute danger signals, and if the record of pupura in this case, incident to the twenty-seventh injection, was known it should have led to the modification or omission of further arsenical treatment. The series of injections 16 months later (August 8 to August 20, 1930) was the first of such treatment following the injection resulting in the pupural reaction, and the first two injections (0.3 gram and 0.6 gram) of the August 8 to August 20 course were not attended by untoward symptoms, so that there was a certain appearance of security, i. e., of tolerance, as a basis for the third injection, six days later.

For statistical purposes the correct primary cause of death is syphilis (not pancreatitis, acute), and the contributory causes—poisoning, neoarsphenamine, acute (antisyphilitic), and pancreatitis, acute. As provision is not made in our statistical system for two contributory causes, however, the logical one to select for entry is poisoning, neoarsphenamine, acute, particularly as the symptoms of the condition which terminated in death were precipitated by the medication, even though death might have resulted later from the pancreatitis, acute, as the contributory cause in the absence of neo-

arsphenamine medication. Even as it was, the pancreatic condition probably increased susceptibility to arsenicals and intensified reaction to the treatment.

A patient, aged 29 years 2 months and 27 days at the time of his death on January 28, 1930, was first admitted with syphilis in October, 1925, at which time he had a mass of condylomata about rectum from which a positive dark-field examination was made on October 30, 1925. A blood Wassermann was 4 plus on November 2, 1925. He received courses of arsenicals as follows: November 4 to December 18, 1925, 7 injections; April 8 to June 16, 1926, 10 injections; February 24 to April 15, 1927, 8 injections; and June 1 to December 17, 1927, 8 injections. Amounts of arsenicals are not recorded; the compound used in the first two courses is not stated. In the third and fourth courses neoarsphenamine was used. His fifth course was begun on January 14, 1930, with 0.3 gram of neoarsphenamine, and the second injection, 0.4 gram, was given on January 21. He received the third dose of this fifth course, consisting of 0.5 gram of neoarsphenamine, on January 28, 1930. No immediate reaction was noted, and patient left the sick bay apparently in good condition at 9.30 a. m. and resumed his duties in connection with the overhaul of his ship. All persons who saw or talked with him during the morning state that nothing unusual was noted in his manner or appearance. About 11 a. m. he was seen running up the high gangway from the navy yard pier to his ship, but did not have conversation with anyone. About 1.55 p. m. he was found in a bunk on board his ship. The medical officer was immediately notified, and on examination the patient was found to be dead and had apparently been dead for about two hours. From the appearance of the body he had apparently been seized with a sudden pain or respiratory difficulty, as he had made an attempt to open his shirt and had opened the trousers, disclosing the abdomen. Autopsy findings were pulmonary tuberculosis, chronic, fibroid, with an acute exacerbation; bronchopneumonia, extensive involvement; pulmonary emphysema; cardiac dilatation; acute congestion of liver, kidney, and spleen.

NONFATAL CASES OF ARSPHENAMINE AND NEOARSPHENAMINE POISONING CLASSED  
AS VASOMOTOR PHENOMENA (1930)

*Arsphenamine*.—No reactions were reported as having resulted from the intravenous injection of 1,393 doses of arsphenamine.

*Neoarsphenamine*.—Excluding the 2 fatal reactions described above, 56 reactions of this class followed the intravenous injection of neoarsphenamine; 28 of the 56 reactions occurred at different times and on different ships or stations during the year; the remaining 28 include one "flare-up" of 19 reactions and another of 9 reactions which are believed to be due to a cause not directly chargeable

to the drug (possibly due to contaminated water). These 56 reactions are presented below in three groups, consisting of 28, 19, and 9 reactions, respectively, with comparative data given in tabular form.

## FIRST GROUP—28 CASES

Course of treatment	Injection	Dose in grams neocarsphenamine	Onset in hours after injection	Duration or reported time of recovery	Apparent first symptoms
First.....	First.....	0.3	7	48 hours.....	General malaise, marked headache, fever.
Do.....	do.....	.3	13	do.....	Severe headache, backache, general achiness, chilliness.
Do.....	do.....	.3	10	24 hours.....	High fever, severe headache, general body pains.
Do.....	do.....	.45	5½	do.....	Fever.
Do.....	do.....	.45	2	6 hours.....	Fever and headache.
Do.....	Second.....	.6	3	7 days.....	Slight chill followed by hot flush.
Do.....	do.....	.9	6	Few hours.....	Severe chill and fever.
Do.....	Third.....	.6	4	48 hours.....	Severe epigastric pains followed by profuse rice-water stools.
Do.....	do.....	.45	3	3 hours.....	Headache and nausea.
Do.....	do.....	.6	4	24 hours.....	Cramping pains in abdomen.
Do.....	do.....	.45	5½	do.....	Chills and headache. (Under treatment for pyelitis.)
Do.....	do.....	.6	3	3 days.....	Severe frontal headache, soreness of eyes, erythematous swelling. (Under treatment for yaws.)
Do.....	Fourth.....	.45	(1)	10 minutes.....	Became pale and lost consciousness.
Second.....	First.....	.45	3	5 hours.....	Fever and headache.
Do.....	Fifth.....	.8	10	(?).....	Abdominal cramps.
Third.....	Fourth.....	.6	(1)	27 hours.....	Nausea and weakness.
Do.....	Fifth.....	.675	3	11 days.....	Nausea, headache, chilly sensations.
Do.....	do.....	.9	1	9 hours.....	High fever, chills, and nausea.
Do.....	do.....	.6	1½	4 days.....	Chills, headache, pains in back, fever.
Fourth.....	Third.....	.45	10½	61½ hours.....	Nausea and vomiting.
Do.....	Eighth.....	.6	2	1 hour.....	Severe headache, backache, nausea, vomiting.
Do.....	do.....	.6	(1)	24 hours.....	Became pale, severe epigastric pains, pulse 50.
Do (?).....	First.....	.45	10	4 days.....	Typical rash and swollen eyelids.
Fifth.....	Second.....	.6	(1)	6 hours.....	Faintness, vertigo, very rapid and weak pulse.
Do.....	do.....	.6	6	3 days.....	Headache, nausea, fever.
Do.....	Third.....	.23	(1)	(?).....	Fever, rapid pulse, vomiting.
Do.....	Eighth.....	.6	48	10 days.....	Pains over entire body, nausea, and vomiting.
Sixth.....	Third.....	.5	½	12 hours.....	General weakness, headache, nausea, chills, fever.

## SECOND GROUP—19 CASES

First.....	First.....	0.3	2	20 hours.....	Headache, chills, fever.
Do.....	Second.....	.3	2	do.....	Headache, chills, fever, dizziness.
Do.....	Third.....	.45	1	do.....	Do.
Do.....	Fifth.....	.45	2	do.....	Headache, chills, fever.
Do.....	Sixth.....	.45	1½	do.....	Do.
Do.....	Seventh.....	.45	1	do.....	Do.
Do.....	Ninth.....	.45	1	do.....	Chills and fever.
Second.....	Second.....	.45	1	18 hours.....	Headache, chills, fever.
Do.....	Seventh.....	.45	1	19 hours.....	Do.
Do.....	do.....	.45	2	do.....	Do.
Third.....	Third.....	.45	1	20 hours.....	Do.
Do.....	do.....	.45	2	do.....	Do.
Fourth.....	First.....	.3	2	do.....	Do.
Do.....	Seventh.....	.45	1	do.....	Do.
Do.....	Eighth.....	.45	2	do.....	Do.
Sixth.....	do.....	.45	2	do.....	Do.
Broken.....	Thirty-fourth.....	.45	2	do.....	Do.
Prov. Kahn.....	First.....	.3	1	19 hours.....	Do.
Do.....	do.....	.3	1	18 hours.....	Headache and fever.

## THIRD GROUP—9 CASES

Second.....	First.....	0.9	From 3 to 7½ hours.	All recovered within 24 hours.	All 9 had fever and severe headache. Most of them (number not stated) had pains and aches in all joints, especially lower extremities.
Do.....	Fifth.....	.45			
Third.....	First.....	.45			
Do.....	do.....	.45			
Do.....	do.....	.9			
Do.....	Second.....	.9			
Do.....	Third.....	.9			
Fourth.....	First.....	.9			
Do.....	do.....	.9			

<sup>1</sup> Immediate.

*Temperature.*—In the 56 reactions included in the above three groups the elevation of temperature was reported as a prominent symptom in 51 instances. The temperature was not mentioned in five instances included in the first group.

*Symptoms.*—The various manifestations encountered in the first group of 28 reactions follow in order of frequency: Fever, 23; headache, 14; nausea, 12; vomiting, 11; chills, 7; delayed arsenic elimination, 5; weakness, 4; rapid and weak pulse, 4; cramps in abdomen, 3; cyanosis, 3; chilliness, 3; diarrhea, 3; albumin in urine, 3; lowered blood pressure (taken), 3; eyes conjunctival and injected, 3; general malaise, 3; pains over entire body, 3; dyspnea, 2; lost consciousness, 2; vertigo, 2; burning in epigastrium, 2; pain in epigastrium, 2; backache, 2; rash, 2; became pale, 2; and one each of the following: Rapid, shallow breathing; coughed up bloody mucus; pain in chest; pain in abdomen; pain in back; pruritis; tachycardia; weak pulse; thirst; scarletinoid eruption; injected tongue, fauces and pharynx; actue pulmonary congestion; tenderness epigastrium; tenderness descending colon; reflexes increased; slight jaundice; swollen eyelids; hot flush; skin hot and dry; anorexia; general achiness; sweating; mental cloudiness; faintness; cyanosis of lips and fingers; cold clammy perspiration; profuse catarrhal discharge from eyes, nose, and mouth; prostration; slow pulse; a desire to defecate but could not; soreness of eyes; severe lumbar soreness; erythematous swelling; leukocytosis.

The manifestations occurring in the 19-case "flare-up" group in order of frequency were: Fever, 19; prostration, 19; headache, 18; chills, 18; nausea, 14; vomiting, 13; muscle pains, 11; diarrhea, 10; vertigo, 2; numbness of fingers and toes, 1; several cases (number not stated) with high fevers developed herpes of the lips the following day.

In the 9-case "flare-up" group all had fever and severe headache and most of them (number not stated) had pains and aches in all joints, especially in the lower extremities, symptoms in all nine cases subsiding within 24 hours. Vomiting was mentioned as having occurred in one case.

*Nonfatal cases—(Case histories).*—A patient who had a history of chancroid in February, 1920, reported with hair falling out, sore throat, and a few lesions in mouth on August 8, 1920, and gave a Wassermann 4 plus blood test at this time. He was given 8 injections of 0.6 gram of salvarsan and 19 injections of one-third grain of mercury. From November 25, 1920, to March 3, 1922, he received 61 injections of mercury oxycyanide (one-fifth grain), and from March 3, 1922, to February 28, 1923, he received 6 injections of "salvarsan" (report does not show whether arsphenamine or neoarsphenamine was used). From February 6, 1923, to March 6,



1930, three blood serum reactions are recorded as being negative. On March 6, 1930, his blood Kahn test was reported as 1 plus; and on March 17 he was started on a course of neoarsphenamine and mercury injections given as follows: February 17, one-fifth grain of mercury succinimide; March 24, two-fifths grain of mercury succinimide; March 31, two-fifths grain of mercury succinimide; April 7, missed; April 14, two-fifths grain of mercury succinimide; March 18, 0.3 gram of neoarsphenamine; March 25, 0.6 gram; April 1, 0.6 gram; April 8, missed because of having eaten breakfast; April 15, 0.6 gram. The last injection of neoarsphenamine, given on April 15, was injected at 11 a. m. Immediately on leaving the table and room the patient became nauseated, weak, and complained of inability to get his breath and of cramps in his stomach. He complained of inability to get his breath again; after being put in a bunk in the ward and covered with blankets, vomited two or three times and lost consciousness. His respiration had become very rapid (about 40 per minute) and shallow, pulse became rapid and weak, and the entire skin became cyanotic. Just after he lost consciousness he was given 10 minims of adrenalin subcutaneously. Inside of two minutes respiration had become more free, radial pulse more palpable, and patient regained consciousness. Pulse, respiration, and state of consciousness rapidly approached normalcy, and uneasiness in chest and abdomen disappeared. At 11.15 a. m. he was given 1 gram of sodium thiosulphate in 10 c c of distilled water intravenously. At 12 noon patient complained of severe pain in chest and abdomen and of chilliness. Both were relieved in five minutes with hot-water bottles and blankets. At 12.30 p. m. patient had a small watery bowel movement and from 12.30 until 2 p. m. "hawked up" small amounts of bloody mucus. Two hundred c c of urine voided at 2.30 p. m. was strongly positive for albumin.

Patient's blood picture was normal three hours after injection (2 p. m.: White blood count, 6,000; red blood count, 4,990,000; hemoglobin, 85 per cent; polymorphonuclears, 66 per cent; lymphocytes, 34 per cent; no abnormal cells seen). The following day at 2 p. m. the temperature, pulse, and respiration were normal; 500 cc of urine had been voided, and the blood picture was: White blood count, 7,000; red blood count, 4,990,000; urine was 2 plus for albumin. Dickens' test not accomplished, due to nonreceipt of materials. During the afternoon and evening the temperature was kept down to 101° and 102° F. by means of ice cap to the head, cool sponges, and alcohol rubs. Fluids were forced, and during the night 390 cc of urine were voided. The injection of neoarsphenamine was made from an ampule in 20 cc of one-half normal salt solution. The salt solution was made from freshly distilled water and was sterilized and cooled to room temperature before mixing with the neoarsphen-

amine. The injection was made immediately following the mixing and filtering. The patient received salts every evening before and urinalysis immediately before every neoarsphenamine injection of this course. After the fourth injection, given April 15, the patient stated that the last dose given two weeks before had made him sick for two days. He had vomited several times that afternoon; water tasted sweet to him, the back of his head and his chest ached, and his appetite was entirely gone; none of this was reported to anyone at the sick bay until after the injection given April 15. Immediately previous to the administration of the injection this date, the patient had been working in the main control room in a high temperature. While he was working the ventilating blowers were shut off for about 15 minutes during fire drill. Patient states that he was very hot when he came directly from the main control room to the treatment room.

A man exposed in Tientsin, China, November 24, 1928, developed an initial lesion which was positive for *Treponema pallidum* on March 19, 1929. On March 22 there was a macular rash over entire body and general adenopathy, and the blood Kahn precipitation test was 4 plus. He was given treatment as follows: From March 17 to April 6, 1929, 6 injections of salvarsan and mercury inunctions daily; from May 8 to June 11, 1929, 6 injections of neoarsphenamine and 20 mercury inunctions; from September 24 to October 16, 1929, 4 injections of neoarsphenamine. The fourth course began on February 26, 1930, with 0.3 gram of neoarsphenamine, and on March 5 and 12 he received 0.45 gram each. No other antiluetic treatment was given during this period. The injection given on March 12 consisted of a solution of 0.9 gram in 20 cc of sterile, triple-distilled water, and 0.45 gram of this solution was administered in four minutes. Ten and one-half hours after this injection a reaction occurred in which there were nausea, vomiting, diarrhea, weakness, vertigo, pruritus of upper and lower eyelids of both eyes, and headache. The blood pressure was 82/60 and there were tachycardia and weak pulse. The temperature was normal for the first 24 hours; the next 48 hours it was 103° to 104° F. The treatment given for the reaction was strychnine (grains  $\frac{1}{10}$ ) by hypodermic; adrenalin (gtts. X) by hypodermic; sodium thiosulphate (grains XV) intravenously 12 hours after administration of the neoarsphenamine and repeated every 24 hours after first dose for a period of 3 days; sodium thiosulphate (grains XV) by mouth every 24 hours for a period of 3 days, together with that given intravenously. Three days after injection of neoarsphenamine, or 61½ hours after onset of symptoms, he was considered recovered, but he was retained on the sick list for 7 days after symptoms cleared up because of weakness.

A patient who was exposed in Seattle, Wash., in May, 1930, later developed initial lesions, and on June 16, 1930, gave a Kahn 4 plus blood test. During the period June 16 to July 2, 1930, he received eleven 1-gram doses of bismuth and two 1-grain doses of mercury salicylate. On June 18 he received 0.3 gram of neoarsphenamine, and on June 25 and July 2 he received 0.45 gram and 0.6 gram, respectfully. The last injection consisted of a 1 to 21 solution, and the report states that the 0.6 gram was injected in five minutes. About four hours after the injection a reaction occurred in which there were severe epigastric pain, profuse rice-water stools, burning in epigastrium, and much thirst. The temperature was 104.8° F., pulse 110, and respiration 30. There was skin diffuse scarlatinoid eruption over whole body; the eyes conjunctival and injected; the tongue injected; fauces and pharynx injected; and chest examination revealed harsh breath sounds; increased tactile fremitus over whole of both lungs; echophony in right axilla; no râles; acute pulmonary congestion. In the abdomen there were tenderness in epigastrium and over descending colon; right side not especially tender. Reflexes increased. At 3 p. m. and 8 p. m. he was given sodium thiosulphate in 1-gram doses and the next morning another 1-gram dose at 8 a. m. The patient completely recovered by July 4, and on July 9 the urine and blood count were normal and he was discharged to duty this date.

A man infected in April, 1928, in New Orleans, La., later gave both Wassermann and Kahn 4 plus blood tests. He received four courses with approximate dates of July, 1928; January, 1929; June, 1929; and September, 1929; and a fifth course, consisting of 0.3 gram of neoarsphenamine, on February 17, and 0.6-gram injections on February 24, March 2, 10, 17, 24, 31, and April 7, 1930. Intramuscular injections of potassium sodium bismuthotartrate in 0.1-gram doses were given on February 13, 20, 27, March 6, 13, 20, 27, and April 3, 1930. The last injection of neoarsphenamine consisted of a 0.9 to 15 solution, and the report states that the rate of injection for the 0.6-gram dose was about five minutes. Two days after this last dose of neoarsphenamine a reaction occurred in which there were pains over the entire body, nausea, and vomiting. There was also a slight jaundice, with evidence of bile in the stools, and a slight albuminuria. One gram of sodium thiosulphate was administered intravenously about 10 a. m. daily on April 9, 10, 11, 12, and 13, and the patient recovered and returned to duty April 19, 1930.

A patient who had a previous history of syphilis was reinfected in November, 1929. There was a typical indurated chancre of glans at urethral orifice which appeared December 15, and which was positive by dark-field examination. He had received three courses for

the previous infection, as follows: October 6, 1927, to April 28, 1928 (two courses), neoarsphenamine seven 0.9-gram injections and eight 0.9-gram injections, and mercury salicylate nine and twelve injections; July 12 to September 13, 1928, neoarsphenamine eight 0.9-gram injections and eighteen injections of mercury salicylate. The fourth course of treatment, or the first course after his reinfection, began with 0.3 gram of neoarsphenamine on December 19, 1929, and was followed by 0.4 gram on January 11, 0.5 gram on January 15, and 0.6 gram injections on January 23 and 30, and February 14, 20, and 28, 1930. The last dose of this course consisted of a 0.6 to 20 solution, and the report states that the rate of injection for the 0.6-gram dose was 10 minutes. Two hours after this last dose a reaction occurred in which there were severe headache, backache, nausea, and vomiting. The temperature was 99, pulse 84, and respiration 18. The urine was negative for sugar, albumin, and microscopic. White blood count, 8,200; polymorphonuclears, 54; small lymphocytes, 43; eosinophiles, 3. The patient was placed in bed with ice cap and given fluids by mouth, and adrenalin one-half cc of 1-1,000 solution subcutaneously repeated in one-half hour. The patient recovered one hour after treatment started and was allowed to return to duty the same date.

A reaction occurred in 1930 in the case of a man having a history of previous reactions. The patient was infected in Habana, Cuba, in January, 1927. The history of previous arsenical treatment appears to be incomplete, but is given here as stated in the report. On January 5, 1927, he was admitted to the sick list with a diagnosis of "chancroid, prepuce." January 26, 1927, he had a cellulitis, right arm, incident to injection of neoarsphenamine. March 3, 1928, Wassermann was negative, and on March 27 Kahn test was 4 plus. On April 17, 1928, a severe "Herxheimer" reaction followed 0.45 gram of neoarsphenamine, and on April 27 another "Herxheimer" reaction followed 0.3 gram. Treatment by this drug was discontinued. On May 5, 1928, Kahn test was again 4 plus; June 14 Kahn test was negative; September 10 Wassermann test was 3 plus and Kahn test 4 plus. April 1, 1929, Kahn test was again 4 plus. Following a course of seven injections of sulpharsphenamine which began August 16, 1928, the blood pressure was 90/50. From May 21 to August 6, 1929, the patient received eight injections of potassium bismuth tartrate (grains  $1\frac{1}{2}$ ), protiodide of mercury (0.01 gram) 364 tablets, and daily inunctions of mercury. Following this treatment the report states that Kahn test was 2 plus. On March 7, 1930, the patient was given an injection of 0.45 gram of neoarsphenamine dissolved in 10 cc of sterile distilled water. It was noted that the patient had a history of previous reactions in 1928, but this injection was tried to make sure arsenical compounds could not be tolerated. Ten hours

after the injection the patient developed a typical rash over entire body, eyelids were swollen, temperature 100, pulse 106, and respiration 20. According to the Dickens' test, man continued to show arsenic in urine for 48 hours after injection. He was put to bed, given liquid diet, forced liquids, and sodium thiosulphate intravenously about 12 hours after the injection of neoarsphenamine. The patient was discharged to duty, well, four days after admission. Since discharge to duty the patient has been given mixed treatment daily and weekly injections of bismuth salicylate 0.13 gram. Repeated tests for albumin in urine have been negative.<sup>1</sup>

A patient was infected in February, 1930, at Guantanamo Bay, Cuba. The initial lesion was positive by dark-field examination and the blood was positive by Kahn test. On April 2, 1930, he was given the first dose of his first course, consisting of 0.3 gram of neoarsphenamine. No other antiluetic treatment had been given. Ten cc of a solution containing 0.3 gram of neoarsphenamine was given in three minutes. A marked reaction followed in about seven hours. The patient exhibited symptoms of general malaise with marked headache, and temperature 105° F., pulse 108, and respiration 22. White blood count, 6,550; polymorphonuclears, 76 per cent; lymphocytes, 24 per cent. The specimen of urine passed three hours after administration was negative for arsenic, while the 6-hour specimen showed a faint trace. The treatment in this case consisted of injections of ephedrine, active catharsis, and sodium bicarbonate by mouth and rectum. The report states that the time of recovery was 48 hours, but the patient was incapacitated for 10 days.

A patient exposed in New York City in December, 1929, developed an initial lesion which was positive by dark-field examination on February 10 and 12, 1930, and on March 14, 1930, the Kahn test was 4 plus. The first dose of his first course was given on February 13, 1930, and the second dose on February 20. These consisted of 0.3 gram and 0.6 gram of neoarsphenamine, respectively. On February 17 he received one-half grain of mercury succinimide. The last dose of neoarsphenamine consisted of 0.6 gram in 12 cc of sterile distilled water at room temperature and was injected in one and one-half minutes. Approximately three hours after the injection there was a slight chill, followed by hot flush, fever 101° F., hot and dry skin. The next day, February 21, the manifestations were anorexia, fever, weakness, and general malaise; on February 23, fever, generalized macular rash. The treatment in this case consisted of rest

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<sup>1</sup> The reporting medical officer states that inasmuch as 14 other patients have received, without reaction, a total of 60 injections of the same lot number, and from the previous history, it is the opinion of the medical officer that the patient had an idiosyncrasy for arsenicals and that this reaction was in no way due to the neoarsphenamine or to the technique of administration.

in bed, eliminative treatment, sponge bath, and alcohol rub. Sodium thiosulphate (0.75 gram) given intravenously. By February 27, the patient was fever free; symptoms entirely subsided.

A man infected in Colon, R. P., March 4, 1930, gave a Kahn 3 plus blood test following an initial lesion. His first course of treatment began April 5, 1930, with 0.3 gram of neoarsphenamine, and 0.45-gram injections were given on April 12 and 19. He received 0.1-gram injections of potassium sodium bismuthotartrate on April 7, 14, and 21, given intramuscularly in gluteal region. The last injection of neoarsphenamine consisted of 0.45 gram dissolved in 10 cc of sterile distilled water injected in three minutes. About three hours after this injection the patient complained of headache, nausea, chills, fever and malaise. His temperature was 103, pulse 104, and respiration 22. The patient was placed in bed and recovered in about three hours, apparently without any special treatment.

A man exposed at Norfolk, Va., May 1, 1930, developed an initial lesion which was positive for *Treponema pallidum* on June 9, 1930. He received the first dose of his first course on June 10, which consisted of 8 cc of a solution containing 0.3 gram of neoarsphenamine. The report states that the rate of injection was five minutes for the dose. As a matter of routine the drug was inspected in the tube before use and also while dissolving and found to be in good condition. It was administered in the usual manner and very slowly. All aseptic precautions were observed. About 13 hours after this injection the patient reported to the sick bay complaining of severe headache, backache, general achiness, and of chilliness. His temperature was 104 and pulse 110. The blood smear showed polymorphonuclears 87 per cent and lymphocytes 13 per cent. Dickens' test was strongly positive at 2 p. m. on June 10, and a faint trace was seen at 4.30 p. m. He was put to bed and at 11.15 p. m. was given ephedrine (grains  $\frac{3}{8}$ ) with water. At 11.30 p. m. he vomited a large amount of undigested food, and at 11.45 p. m. he vomited again, after which he said that he felt better. Temperature at 12.30 a. m. (June 11) was 103.2° F. and pulse 111, and at 3.50 a. m., 100° F. and 90. He was given ephedrine (grains  $\frac{3}{8}$ ) at this time. At 8 a. m. the temperature was normal and he said that he felt fine, but was held under observation until June 12, when he was sent to duty under treatment.<sup>2</sup>

A case in which the time and place of infection were given as unknown began his first course of treatment on April 3, 1930, with 0.4 gram of neoarsphenamine, and he received 0.9 gram on April 10 as the second injection. The second dose consisted of 0.9 gram di-

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<sup>2</sup> One other patient was given the other half of the same solution with no reaction whatever. On June 26 another dose of this preparation, of the same lot number, was administered to this man under the same conditions prevailing as before and no reaction was obtained.

luted in 30 cc of distilled water, with the rate of injection of about 3 minutes for the 30 cc of solution. About six hours after this injection the patient had a severe chill, a temperature of 104° F., accompanied with sweating, nausea, and vomiting. He was transferred to a naval hospital immediately after the onset of symptoms, where he recovered within a few hours, apparently without any special treatment, and was returned to duty on April 18, 1930.

A case in which the time and place of infection were given as unknown gave positive blood tests, as follows: January 30, 1929, Kahn 4 plus; February 28, 1929, Kahn 3 plus; March 21, 1929, Kahn 3 plus; and March 28, 1929, Kahn 4 plus. From April 3 to May 22, 1929, he received eight injections of neoarsphenamine, amounting to 3.7 grams, and from July 13 to September 9, 1929, eight injections, totaling 4.65 grams, and daily mercury inunctions from July 13 to August 31, 1929. On March 27, 1930, the blood test was Kahn 2 plus, and injections of neoarsphenamine were given—0.315 gram on April 7, 0.45 gram on April 14, 0.63 gram on April 21 and 28, and 0.675 gram on May 5, 1930. The fifth dose of the third course consisted of 15 cc of a solution containing 0.675 gram of neoarsphenamine, and the rate of injection was five minutes for the dose. Three hours after this injection the Dickens' test was only faintly positive, and the patient at this time complained of nausea, headache, and chilly sensations. There was a history of similar reactions from previous injections. Immediately after the onset of symptoms the patient was transferred to a naval hospital, where, upon arrival, he was given 1 gram of sodium thiosulphate intravenously and forced fluids. At the hospital there was still a trace of arsenic in the urine. Laboratory report on May 7 gave Van den Bergh qualitative delayed, quantitative less than 1 mg per liter. Icterus index 5. Kahn negative. The patient recovered and was discharged to duty as well on May 16, 1930.

A patient exposed in Norfolk, Va., May 27, 1930, developed secondary manifestations July 26, and blood-serum reaction was Kahn 4 plus July 29, 1930. The first dose of the first course of treatment consisted of 20 cc of a solution containing 0.3 gram of neoarsphenamine, and the rate of injection was 45 seconds. This injection was given on July 31 and was followed in 10 hours by a reaction described as moderately severe. The reaction was characterized by high temperature (104.6° F.), severe headache, generalized body pains, cyanosis, and mental cloudiness with no chills. The blood pressure remained sustained (120/80); the pulse was full, regular, and 88 per minute. There were no signs of shock. Two specimens of urine were passed after the neoarsphenamine was injected, and due to error the first was not examined. The second specimen was

negative for any trace of arsenic. Routine urinalyses were negative before and after injection. Fluids were forced and 1 gram of sodium thiosulphate was given about 1 hour after the onset, followed by marked improvement in less than 30 minutes. Temperature dropped to 101° F., the cyanosis and mental disturbance cleared, and the patient felt much better. The condition was normal the following morning.

A patient with a history of primary lesion and Wassermann 4 plus blood test in March, 1924, had received arsenical treatment, neoarsphenamine, as follows: April 30 to May 27, 1924, four injections; June 3 to August 27, 1924, eight injections; May 20 to June 27, 1928, six injections; August 14 to October 2, 1928, eight injections. and for the fifth course, 0.45 gram July 8 and 0.6 gram July 15, 1930, with daily inunctions of mercury ointment for one week. The dilution for the second dose of the fifth course was 3 mls of sterile water to each 0.1 gram of neoarsphenamine and the rate of injection about 1 c c of diluted solution every 15-20 seconds. Immediately following this injection a reaction occurred which was characterized by faintness, vertigo, very rapid and weak pulse, injection of eyes, moderate cyanosis of lips and fingers with coldness, cold clammy perspiration, profuse catarrhal discharge of eyes, nose, and mouth, and prostration. Treatment consisted of immediate injection of 1 mil of 1:1,000 adrenalin chloride hypodermically, external massage, and rest in bed. One gram of sodium thiosulphate was given intravenously about three minutes prior to the injection of neoarsphenamine, because the patient had stated he had always had slight reactions of similar nature following arsenical injections. Recovery from reaction was apparently complete after six hours.<sup>3</sup>

A patient with history of exposure at Guantanamo Bay, Cuba, August 25, 1925, developed lesions (mucous patches) October 8, in which *Treponema pallidum* was found. His first course of arsenicals began October 9, 1925, and consisted of eight injections, and his second course began June 18, 1928, which also consisted of eight injections. For his third course he received 0.6-gram doses of neoarsphenamine on March 11, 18, and 25, and April 1 and 8, 1930, and bismuth salicylate, 2 grains each dose intramuscularly (buttocks) on March 6, 13, 20, 27, and April 3, 1930. The fifth dose of the third course, given on April 8, 1930, consisted of 0.6 gram of neoarsphenamine in a 1 to 35 solution and the rate of injection was 1 c c per second. About one and one-half hours after receiving this injection the patient began to have chills, headache, and pains in the back,

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<sup>3</sup> The reporting medical officer states: "It is believed that this man has a very low tolerance to arsenicals, in view of the fact that he stated he always had slight reactions after each injection, and has been the only patient exhibiting any toxicity from the same preparation."



and his temperature was 102° F. He was immediately transferred to a naval hospital, where he was put to bed and given free catharsis and force fluids. All urine for the first 12 hours showed a trace of arsenic, and the entry, "This man does not eliminate arsenic within 6-hour period and it is considered dangerous to give him additional arsenic preparations intravenously," was recorded. No arsenic was found in the urine on April 10, and the man was considered recovered on April 12, or four days after the injection.

A patient infected in Managua, Nicaragua, July 1, 1929, had a generalized rash and gave a Kahn 4 plus blood test August 12, 1929. From August 12 to August 20, 1929, he received two injections of neoarsphenamine (amount not stated); from September 19 to November 7, 1929, eight injections of neoarsphenamine, totaling 6.3 grams; from February 20 to April 10, 1930, eight injections of neoarsphenamine, totaling 3.6 grams. The next course of neoarsphenamine was given from July 10 to September 11, 1930, and consisted of one 0.3-gram, six 0.45-gram, and one 0.6-gram injections. The report states that no other concurrent treatment was given during the course. The last dose, given on September 11, consisted of 15 c c of a solution containing 0.6 gram of neoarsphenamine and the rate of injection was three minutes for the 15 c c. Immediately after receiving this injection of 0.6 gram the patient became pale and complained of rather severe epigastric pains. Pulse, 50; blood pressure, 110/50; and temperature, 98° F. Following the injection he was immediately given 1 cc of adrenalin and 1 gram of sodium thiosulphate in 10 c c sterile water intravenously; 10 minutes later the heart sounds were normal, the heart beat forceful and regular but slow. He stated that the pain had disappeared and that he felt no dizziness, but a slight weakness. At this time the patient was still slightly pale. The urine was normal before injection, and Dickens' test positive three and six hours after injection. September 12, 1 gram of sodium thiosulphate was administered intravenously and the patient was symptom free this date. September 18 the patient was examined and there was no evidence of any abnormal sequela following injection of neoarsphenamine administered one week previously. He was given one-fiftieth grain of atropine 20 minutes before the initial dose of 2 c c of neoarsphenamine; 13 c c of neoarsphenamine given one hour later with no symptoms (0.6 gram of neoarsphenamine). On September 24, 0.6 gram of neoarsphenamine was again administered intravenously. The urine test was negative before injection and Dickens' test positive for arsenic elimination three and six hours after injection.

A patient infected February 23, 1926, in Naples, Italy, developed an initial lesion, macular rash, and blood test Kahn 2 plus. He re-

ceived his first and second courses in 1926, his third course in 1927, and his fourth and fifth courses in 1928. The report does not give the dates for the injections of the sixth course, but that two injections of 0.6 gram each preceded the 0.5-gram dose given in September, 1930, which was followed by reaction. This third dose of the sixth course consisted of 10 c c of a solution containing 0.5 gram of neoarsphenamine and the rate of injection is stated to be two to three minutes. Five minutes after this injection the patient developed general weakness, headache, nausea, chills, and a temperature of 104° F. There was a large amount of albumin in the urine. The patient recovered in 12 hours under general care and no special treatment was given.

A patient infected in January, 1930, at Los Angeles, Calif., reported February 27 with an initial lesion, adenopathy, and gave a Kahn 3 plus serum reaction this date. From March 18 to June 10, 1930, he received eight intramuscular injections ( $\frac{1}{5}$  grain) of mercury succinimide and eight intravenous injections of neoarsphenamine, totaling 4.5 grams. His second course consisted of 0.3 gram injections of neoarsphenamine given on August 5 and 12, 1930, and 0.8 gram injections given on September 3, 9, and 16, 1930. The fifth dose of the second course consisted of a 1 to 20 solution and the rate of injection was 8 c c of this solution per minute. This injection was given at 11 a. m. on August 12, and the patient was taken ill that night, approximately 10 hours later, while on liberty and attending a dance. He was taken via ambulance to a naval hospital, complaining of abdominal cramps. The symptoms noted at the hospital were vomiting, with acute cramps diffuse over whole abdomen. No definite localization or findings. Otherwise negative. He was put to bed on liquid diet and recovered apparently without any special treatment. He returned to duty on September 23, 1930, and on October 1 he was given 0.45 gram of neoarsphenamine of the same lot number as before with no symptoms of reaction.

A patient infected at San Francisco, Calif., in August 1930, reported with a primary lesion which failed to show *Treponema pallidum*, but he later developed secondaries, adenopathy, and a Kahn 4 plus blood test. He was given the first injection of his first course on September 16, 1930, which consisted of 0.45 gram of neoarsphenamine in 10 c c of water injected in one minute. He had received inunctions of mercurial ointment, half strength, 1 gram daily for the previous five days. No other treatment. Five and one-half hours after this first injection of neoarsphenamine, or at 4 p. m., his temperature was 102° F., and at 8 p. m. it was 104° F. The patient vomited twice. Dickens' test twice showed normal excretion of arsenic. At 8 p. m. he was given 1 gram of sodium thiosulphate intra-

venously, and he felt well, and temperature was 99° F. the following morning.<sup>4</sup>

A case in which the time and place of infection and how diagnosed are not shown in the report was receiving his first course of treatment. He received 0.3 gram of neoarsphenamine June 23, 0.45 gram July 1, and 0.6 gram July 8, 1930. No other treatment given. The third injection of his first course, that given on July 8, consisted of 20 c c of a solution containing 0.6 gram of neoarsphenamine and the rate of injection was one and one-half minutes for the 20 c c. About four hours after this injection a reaction occurred which was characterized by cramping pains in the abdomen, nausea, vomiting, and a desire to defecate but could not. His temperature was 99° F., pulse 66, respiration 20, and blood pressure 110/50. He was given an enema, magnesium sulphate (2 ounces), and soft diet. Recovery was complete the following morning, and he was sent to duty July 11, 1930.

A case in which the time and place of infection and how diagnosed were not stated in the report was receiving his first course of treatment, which consisted of 0.45-gram injections of neoarsphenamine on November 22, 29, December 6 and 13, 1930, and 0.025-gram intramuscular injections of a bismuth preparation on November 28, December 5 and 12, 1930. The fourth injection of neoarsphenamine, that given on December 13, consisted of 20 c c of a solution containing 0.45 gram and the rate of injection was from three to five minutes. Immediately following this injection the patient complained of feeling faint. He became very pale and lost consciousness. He was laid on the deck and 1 c c of adrenalin was given intramuscularly at once. No pulse was perceptible when patient was laid on the deck, but pulse returned immediately following the administration of the adrenalin. The patient felt as usual in about 10 minutes and has had no permanent symptoms.

A patient who was exposed at Managua, Nicaragua, September 14, 1930, developed an initial lesion, dark-field examination of which was positive for *Treponema pallidum* November 18, 1930. He was given the first dose of his first course November 19, which consisted of 12 c c of a solution containing 0.45 gram of neoarsphenamine and the rate of injection was three minutes for the 12 c c. Two hours later there was a slight elevation in temperature and headache. He

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<sup>4</sup> The reporting medical officer stated that the patient was one of 25 men who received neoarsphenamine in the same size doses, from the same lot number, and on the same day. This was the patient's first injection. All others had had previous injections. No other severe reactions occurred. Patient was not at any time seriously ill. Dickens' test showed normal eliminat of arsenic, and it is believed that symptoms were largely the result of psychological effect of first intravenous medication. Also, at time of intravenous injection, patient had a well-defined rash. The sudden destruction of large numbers of *Treponema pallidum*, with the resultant liberation of toxins, was probably a contributing factor.

was put to bed and given 10 grains of aspirin and recovered in six hours.

A patient exposed at Managua, Nicaragua, in March, 1930, gave positive Kahn and Wassermann tests May 21, 1930. He was given a course of seven injections of arsenicals, presumably neoarsphenamine, from May 29 to July 9, 1930. In November, 1930, a second course was begun with 0.45 gram of neoarsphenamine dissolved in 12 c c of distilled water and the rate of the injection was three minutes for the 12 c c. Three hours later there was a slight elevation of temperature and headache. He was given 10 grains of aspirin and put to bed under observation. Five hours later he recovered.

In 1930 two reactions occurred in the same man. The patient was infected at Norfolk, Va., July 8, 1920, and had received treatment as follows: September 17 to October 29, 1920, 3.3 grams of "salvarsan"; September 30 to October 10, 1921, and 0.3 grams salvarsan and 12 mercury; August 11 to October 1, 1926, 8 injections of salvarsan and 7 injections 1 grain each of mercury; March 21 to May 4, 1928, 7 injections of salvarsan, amounting to 4.5 grams, and 6 injections 1 grain each of mercury; August 20 to November 7, 1928, 12 injections of bismuth (1 c c each); and February 28 to May 2, 1930, 8 injections of bismuth (1 c c each). On June 17, 1930, his blood Wassermann was 4 plus, and it was considered best that the patient be given arsenical treatment, although he stated that formerly it made him feel bad at times. He was given 0.3 gram of neoarsphenamine on July 8, without reaction. On July 19, he was given 0.6 gram of the same preparation at 10 a. m., and at 4 p. m., or six hours ately, in which there was an elevation of temperature to 101° F., pulse soft and rapid, and slight dyspnea. He was put to bed with ice cap to head and given 10 minims of adrenalin by hypodermic injection. After four hours symptoms subsided, and the next day he felt well, but the pulse was still rapid and soft. He was returned to duty on the third day. On July 25 he was tried again with 0.23 gram of neoarsphenamine, which caused a slight reaction immediately, in which there was an elevation of temperature to 101°F., weak rapid pulse, and vomiting. Examination of urine by the Dickens' test showed proper elimination of arsenic. The time of recovery from the second reaction is not given on the report.

In 1930 nineteen reactions occurred which, in the opinion of the reporting medical officer, were due to the condition of the water used in making the solutions of neoarsphenamine for intravenous injection. On August 1, 1930, twenty-nine men were given neoarsphenamine intravenously as treatment for syphilis aboard the U. S. S. *John D. Ford* while at Chefoo, China. Nineteen men, or 65.5 per cent, had severe reactions, the symptoms of the reactions appearing

in all cases in from one to two hours after receiving the injections. The first reaction reported occurred about one hour after receiving the injection, and the first man to receive an injection was also the first to have a reaction. Every few minutes from then on reactions were reported, and within two hours after the first injection was administered, 19 men were reported sick. The 10 men who received treatment but who did not suffer a reaction were the last 10 men to be treated. In mixing the neoarsphenamine for these last 10 patients, water from a different source (obtained from the United States naval hospital, Canacao) was used. The water used in mixing the neoarsphenamine which caused the reaction in the first 19 men to be treated was obtained from the U. S. S. *Black Hawk*. In both instances the water was triple distilled and sterilized. The reason for using water from a different source in the case of the group of the last 10 men treated was only due to the fact that there was no more of this water from the U. S. S. *Black Hawk* prepared. A sample of the water used in mixing the doses that caused the reactions was obtained. It had a peculiar acidlike odor, but reacted neutral to litmus paper. The reporting medical officer notes that similar reactions are described by Stokes in his book, "Modern Clinical Syphilology," on page 304, under "Arsphenamine Reactions No. 9," due to impurities or acidity from rubber tubing. The dosage in all cases was either 0.3 gram or 0.45 gram, given very slowly. No technical faults were noted. All instruments, glassware, syringes and needles were properly cleaned and sterilized. Procedure of administration was the same and the same man assisted in the operations as in the past. The same preparation of neoarsphenamine, of the same lot number and the product of the same manufacturer, was used in all 29 injections. All men treated received usual preparation, such as laxative the night before and fasting stomach prior to injection. Urine in all cases was negative for albumin. The symptoms in all cases were practically the same, beginning with headache, chills, fever as high as 105° F., prostration, muscle pains, nausea, vomiting, and diarrhea. Several cases with high fevers developed herpes of the lips the following day.

The treatment consisted of rest in bed, symptomatic and palliative, and 10 minims of adrenalin was given subcutaneously to most cases. Recovery was practically complete in 24 hours, except for herpes and a general feeling of malaise. Temperatures were normal, and most men returned to duty the following day, 20 hours later. It was the opinion of the reporting medical officer that the untoward symptoms were due to an acid reaction of the water used in mixing the neoarsphenamine, which caused a moderately severe and acute arsenical poisoning. The individual cases, while included in the figures for

vasomotor phenomena, are not described at length here, due to the fact that, from the evidence submitted, the water was undoubtedly responsible for these 19 reactions. The condition of the still on the U. S. S. *Black Hawk* is not given in the report, but the similarity in the symptoms in these 19 reactions to those of the so-called "tubing reactions" leads one to wonder if in some manner new rubber tubing had been used in rigging up the still that produced the water in question without first treating the tubing to render it free from removable impurities. The standard instructions for medical officers of the Army, Navy, and United States Public Health Service states that before being used the first time the tubing should be filled with normal sodium-hydroxide solution for not less than 6 hours. It should then be thoroughly rinsed in water, sterilized by boiling, and then thoroughly rinsed with sterile water again just before using. Although this precaution is applied to the material used in the gravity apparatus, it would also apply to rubber tubing used in the preparation of the distilled water. However, there is no evidence at hand to show that any rubber tubing was used in this case, so that the above is not conclusive. Reactions are known to be produced by the presence of impurities in water other than those obtained from rubber tubing, such as contamination by the condensing water due to cracks in the condensing worm, and water which has been distilled and kept for a few days becoming contaminated with bacterial or chemical substances, etc. The following is quoted from *Modern Clinical Syphilology* (Stokes), page 193, which may be of interest in this connection:

"Shaffer noted (personal communication) that the water supply of a camp which had been precipitated with alum and treated with chlorine, as are many city water supplies, could not be made into pure distilled water by any distillation process, unless the original water was first alkalinized with NaOH to form NaCl from the Cl<sub>2</sub> and AlOH from the alum. On investigating a series of reactions on the service we found that in distilling with steam from boiler water on a large scale, especially if the water was first passed through a softening device before it was fed to the boilers, or if boiler anti-scale compounds were used, the first distillation did not produce as good a water, chemically speaking, as could be obtained from the tap. For a considerable period this had been an unrecognized source of trouble on my service and had finally obliged us to purchase a reagent-distilled water from a chemical-supply concern for our first distillation, whereupon the reactions disappeared. Chemical studies then disclosed the difficulty."

It is unfortunate that destroyer division medical officers, who have the personnel of some six destroyers under their care, have to depend on larger ships or shore stations for such items as distilled

water. With the closest observance of the methods of administration to avoid any possible errors in technique he is still handicapped by the lack of equipment for making freshly distilled water for medicinal use.

Another ship reported an instance in which 9 reactions occurred with signs and symptoms similar to the 19 cases noted above, but in these 9 reactions the cause was not determined. It is assumed from the report that a total of nine injections were given on the same date, all nine injections producing a reaction. The facts as reported are as follows: On August 5, 1930, nine injections of neoarsphenamine, of the same lot number and make, were administered about 9.30 a. m. From about 12.30 to 2 p. m., eight of the nine patients receiving this treatment reported to the sick bay, with temperatures ranging from 102° to 103.6°, all complaining of severe headache and most of them complaining of pains and aches in all joints, especially the lower extremities. All of these patients had received arsenical treatment previously. Three received 0.45 gram, the first injection of the current course. The other six received 0.9 gram. One of the men went ashore and did not report to the sick bay. He was interviewed the following morning at 8 o'clock; his temperature was normal. He stated that he felt normal after receiving the injection until about 5 p. m.; then had a severe headache until about 9 p. m.; he vomited, and soon afterwards his headache subsided. He also stated that he noticed dull aching pains about his hip joints about 8 p. m. All of the men received a purgative on the evening before treatment, and all stated that they ate no breakfast the following morning. The arsenicals were administered by the syringe method. Nineteen ampules of this same lot number had been administered previously without any noticeable reactions. Three of the 9 men had received 2 injections each of this same lot in the 2 preceding weeks.

Two ampules of the neoarsphenamine were forwarded to the bureau for analysis, and the product was found to pass satisfactory toxicity tests by the National Institute of Health, United States Public Health Service. The following is quoted from the report of examination of the samples submitted: "In view of the results of our test, we believe this lot to be satisfactory for clinical administration. The fact that 19 ampules of this lot number were previously used without any noticeable reactions confirms our findings of not being unusually toxic."

An accurate check on the experience with the various lot numbers used in the Navy during 1930 is not possible, due to the fact that many activities were still using the old Form A and were not including lot numbers in their reports. Out of 77,126 doses of neoarsphenamine of the same manufacture as was used in these nine cases,

9,480 were reported without including the lot numbers. However, all lots of this make, as reported, in which there were reactions, together with those in which 1,000 or more doses were given during the year, follows:

Number of doses of separate lots	Reactions, all types	Ratio of reactions to doses	Ratio of reactions of doses excluding the 19 and 9 groups
3,026	1	1 to 3,026	1 to 1,319.
1,832	0	0 to 1,832	
5,274	23	1 to 229	
1,786	0	0 to 1,786	
1,262	2	1 to 631	
557	1	1 to 557	
1,098	0	0 to 1,098	
281	2	1 to 141	
1,112	1	1 to 1,112	
2,062	5	1 to 412	
818	6	1 to 136	
1,914	1	1 to 1,914	
3,188	4	1 to 797	
2,476	8	1 to 825	
1,115	2	1 to 558	
1,834	0	0 to 1,834	
3,242	3	1 to 1,081	
2,607	1	1 to 2,607	
1,568	3	1 to 523	
1,625	0	0 to 1,625	
902	2	1 to 451	
1,407	2	1 to 704	
745	1	1 to 745	
1,824	1	1 to 1,824	
5,660	1	1 to 5,660	
1,192	0	0 to 1,192	1 to 1,328.
2,610	0	0 to 2,610	
2,655	11	1 to 241	
429	1	1 to 429	

The total number of doses of various lot numbers of this manufacture given during the year was 77,126, with 77 as the total number of reactions, making the ratio of reactions to doses 1 to 1,002. The total number of doses of neoarsphenamine of all makes and lot numbers given during the year was 85,646, with 82 as the total number of reactions, making the ratio of total reactions to the total number of doses of neoarsphenamine given 1 to 1,044.

If the 19 reactions in the first case may be excluded as not being due to the drug, the ratio of reactions to doses for that lot is 1 to 1,319, and if the 9 reactions in the second case may be excluded for the same reason the ratio of reactions to doses for that lot is 1 to 1,328. These ratios compare favorably both with the ratio of all reactions experienced by the administration of 77,126 doses of various lot numbers of this make of neoarsphenamine (1 to 1,002) and the total reactions experienced by the administration of all doses of neoarsphenamine of all makes used during the year (1 to 1,044), which would seem to give emphasis to the laboratory findings that the drug was not unusually toxic.

While the amount of arsenicals received by all nine of these patients had been excessive, this item does not seem to be a positive



factor in this particular flare-up of reactions. However, because of the fact that the dosage in each case had been excessive, which may have had some bearing as a contributory cause, a summary of treatment received by each of the nine patients is tabulated below and compared with the dosage of 0.45 gram, as recommended by the Bureau of Medicine and Surgery circular letter, Serial No. 492-1929, of October 25, 1929.

Dates	Treatment recorded	Total in grams	Amount in excess of dosage recommended by bureau letter (grams)
Mar. 27 to Apr. 30, 1930.....	1 of 0.45.....		
June 10 to July 1, 1930.....	5 of 0.9.....	4.95	2.25
July 22 to Aug. 5, 1930.....	4 of 0.9.....	3.60	1.80
May 2 to June 2, 1930.....	3 of 0.9.....	2.70	1.35
July 2 to Aug. 1, 1930.....	32 Hg. inunctions.....		
	31 Hg. inunctions.....		
Mar. 27 to Aug. 5, 1930.....	1 of 0.45.....		
	12 of 0.9.....	11.25	5.40
Mar. 21 to May. 6, 1930.....	1 of 0.45.....		
June 10 to July 1, 1930.....	5 of 0.9.....	4.95	2.25
Aug. 5, 1930.....	4 of 0.9.....	3.60	1.80
Mar. 21 to Apr. 23, 1930.....	1 of 0.45.....	.45	
	34 Hg. inunctions.....		
Mar. 21 to Aug. 5, 1930.....	2 of 0.45.....		
	9 of 0.9.....	9.0	4.05
Dec. 18, 1929, to Jan. 15, 1930.....	3 of (?).....	(?)	(?)
June 12 to July 30, 1930.....	4 of 0.9.....	3.60	1.80
Aug. 5, 1930.....	1 of 0.45.....	.45	
July 8 to Aug. 8, 1930.....	32 Hg. inunctions.....		
Dec. 18, 1929, to Jan. 15, 1930.....	3 of (?).....	(?)	(?)
June 12 to Aug. 5, 1930.....	1 of 0.45.....		
	4 of 0.9.....	4.05	1.80
Apr. 4 to May 6, 1930.....	1 of 0.3.....	.3	(-.15)
	1 of 0.45.....	.45	
June 17 to July 2, 1930.....	2 of 0.9.....	1.80	.90
	1 of 0.45.....	.45	
Aug. 5, 1930.....	3 of 0.9.....	2.70	1.35
Apr. 23 to May 24, 1930.....	1 of 0.45.....	.45	
	32 Hg. inunctions.....		
Apr. 4 to Aug. 5, 1930.....	1 of 0.3.....		
	3 of 0.45.....		
	5 of 0.9.....	6.15	2.10
May 20 to July 15, 1929, 14 injections Hg.; mixed treatment.....	8 of (?).....	(?)	(?)
Aug. 15, 1929 to (?), 9 injections Hg.....	10 of (?).....	(?)	(?)
May 20 to June 25, 1930, 31 Hg. inunctions.....	6 of 0.9.....	5.40	2.70
Aug. 5, 1930.....	1 of 0.9.....	.9	.45
May 20 to Aug. 5, 1930.....	7 of 0.9.....	6.30	3.15
February 16 to April 5, 1928.....	7 of (?).....	(?)	(?)
May 21 to July 2, 1928, 15 Hg. inunctions.....	7 of (?).....	(?)	(?)
January 18 to April 5, 1929.....	6 of (?).....	(?)	1 (?)
August 5, 1930.....	1 of 0.9.....	.9	.45
August 5, 1930.....	1 of 0.9.....	.9	.45
March 12 to April 22, 1930.....	1 of 0.45.....	.45	
	5 of 0.9.....	4.50	2.25
April 22 to May 25, 1930, 34 Hg. inunctions.....	1 of 0.9.....	.9	.45
August 5, 1930.....			
March 12 to August 5, 1930.....	1 of 0.45.....		
	6 of 0.9.....	5.85	2.70

<sup>1</sup> 20 unknown.

Dates	Treatment recorded	Total in grams	Amount in excess of dosage recommended by bureau letter (grams)
February 11 to March 11, 1930.....	4 of 0.45.....	1.80	
May 10 to June 17, 1930.....	2 of 0.9.....	1.80	.90
July 29 to August 5, 1930.....	4 of 0.9.....	3.60	1.80
March 11 to August 5, 1930, 30 Hg. inunctions.....	1 of 0.45.....	.45	
	1 of 0.9.....	.9	.45
February 11 to August 5, 1930.....	5 of 0.45.....		
	7 of 0.9.....	8.55	3.15
January 8 to February 12, 1930.....	1 of 0.45.....	.45	
	5 of 0.90.....	4.50	2.25
February 19 to February 26, 1930.....	2 of 0.90.....	1.80	.90
May 20 to June 30, 1930.....	1 of 0.45.....	.45	
	2 of 0.90.....	1.80	.90
August 5, 1930.....	1 of 0.90.....	.90	.45
February 5 to February 25, 1930, 21 Hg. inunctions.....			
July 1 to July 31, 1930, 31 Hg. inunctions.....			
January 8 to August 5, 1930.....	2 of 0.45.....		
	10 of 0.90.....	9.90	4.50

From the fact that 19 ampules of this same lot had been administered previously on the same vessel without noticeable reactions, the fact that only two other reactions resulted throughout the service from the administration of 2,655 doses known to be of the same lot, the results of the laboratory examination of the drug, and a comparison of experiences with this lot of neoarsphenamine to the experiences with other lots, it appears that the drug in this instance—that is to say, neoarsphenamine of this lot number and make—can be eliminated as the cause of these nine reactions. If this conclusion may be accepted, the fact that all nine injections produced reactions would seem to imply that the cause originated locally—as, for example, if a solution had been prepared by dissolving several ampules at the same time and injections made from a common solution, one bad tube could have spoiled the whole; but if a tube of neoarsphenamine had deteriorated enough to produce the nine reactions it is probable, though not necessarily certain, that the condition of the contents of the bad tube would have been noticed upon the examination of the ampules when preparing to make the solution. Whether or not something went wrong with the water is conjectural, though there is a similarity in this incident of the 19 cases noted above in which there is little doubt that the water was in fact the causative agent. It appears that contaminated water in this case should be included as a possibility, regardless of the fact that nothing concerning it is noted in the report.

A patient with no syphilitic history was receiving small weekly doses of neoarsphenamine for a chronic left pyelitis. He was given 0.3 gram of neoarsphenamine October 17 and 0.45 gram injections

on October 24 and 31, 1930. The third injection consisted of a 1 to 20 solution and the 0.45 gram dose was injected in two minutes. Five and one-half hours later the patient had chills, headache, nausea, and vomiting, and his temperature was 103° F. One gram of sodium thiosulphate was given immediately following initial symptoms with considerable relief, and one gram again the following morning. Recovery was slow, but there was steady improvement over a period of the next 24 hours.

In 1930 there was one severe reaction reported following the administration of neoarsphenamine given in the treatment of yaws. The patient, a seaman, second class, United States Navy, was presumably a native of American Samoa, though this fact is not stated on the report. On October 14, 1930, he was given 0.45 gram of neoarsphenamine intravenously, and on October 21 and 28, 0.6-gram injections. The report states that in the course of treatment no mercurial compounds were given. Three hours after the 0.6-gram dose given on October 28 the patient complained of severe frontal headache, soreness of eyes, generalized pains with severe lumbar soreness, and sense of burning in the region of the stomach. On examination the eyes were reddened and watery and the lumbar region was somewhat painful to palpation. The heart, chest, and abdomen were negative. The skin was negative at the time of admission to the sick bay, although the patient gave a history of erythematous swelling at onset of reaction. The temperature was 102.8° F., pulse 108, and respiration 24. White blood count, 14,000; polymorphonuclears, 69 per cent. Dickens' test: 2 plus at the end of 3 hours, 1 plus at the end of 6 hours, 1 plus at the end of 24 hours, and negative at the end of 48 hours. He was given sodium thiosulphate intravenously, adrenalin (10 minims) under tongue, ice bag to head, and morphine sulphate ( $\frac{1}{4}$  grain), atropine sulphate ( $\frac{1}{160}$  grain) hypodermically. By October 31, or three days after receiving the neoarsphenamine, he was symptom free and returned to duty that date.<sup>5</sup>

#### DERMATITIS AND DERMATITIS EXFOLIATIVA

*Deaths.*—No fatal cases of dermatitis exfoliativa occurred during the year 1930.

Fatality figures are available for the 4-year period 1927–1930. During this 4-year period there were 53 cases with 4 deaths following the use of neoarsphenamine and 3 cases with no deaths following the use of sulpharsphenamine. The case fatality rate for the neo-

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<sup>5</sup> The reporting medical officer states: "This reaction is thought to be due to faulty elimination and idiosyncrasy of patient and not to toxicity of drug used, as five treatments were given from a common mixture at this time."

arsphenamine cases as determined by these figures is therefore 7.55 per cent.

*Nonfatal cases of dermatitis exfoliativa, or arsenical dermatitis.*—During the year 1930 there were 13 cases, 12 of which followed the use of neoarsphenamine and 1 followed the use of sulpharsphenamine. Some of the available data for these cases are presented below in tabular form.

## NEOARSPHENAMINE

Previous courses of treatment	Current course of treatment						
	Dose followed by dermatitis	Total grams	Number of days in course	Average milligrams per day	Concurrent treatment	Onset of dermatitis after last dose	Duration of dermatitis (days)
None (?) <sup>1</sup> .....	First.....	0.45	1		None.....	8 days....	(?)
None.....	Third.....	1.8	10	180	3 doses bismuth salicylate.	1 day....	109
Do.....	Fourth.....	2.4	21	114	4 injections of bismuth.	10 days..	128
Do.....	Seventh.....	3.9	45	87	8 injection of bismuth.	6 days....	(?)
Do.....	do.....	3.45	43	80	Mercury rubs twice a week.	5 days....	38
Do.....	Eighth.....	5.85	50	117	None.....	8 days....	61
Do.....	Fourteenth.....	8.2	51	161	33 mercury rubs...	9 days....	47+
Aug. 28 to Oct. 2, 1929, 4.8 grams neoarsphenamine and 6 mercury rubs.	First.....	.6	1		None.....	1 day....	44
June 26 to Aug. 15, 1930, 3.9 grams neoarsphenamine and mercury rubs, with dermatitis about Aug. 1, 1930.	Eighth.....	3.78	54	70	Mercury rubs.....	During course.	62+
June 1 to July 19, 1929, 8 injections arsenical and 6 injections mercury bichloride and 2 injections mercury succinimide; Sept. 6 to Nov. 1, 1929, 6.3 grams neoarsphenamine and 2½ grains mercury succinimide.	Sixth.....	3.6	42	86	None.....	7 days....	(?)
July 27 to Aug. 26, 1927, 5 injections arsenical and 19 mercury rubs; Aug. 11, 1927, to Apr. 12, 1928, 7 injections arsenical, followed by dermatitis with 148 sick days; June 4 to July 31, 1929, 6 injections arsenical and mercury rubs; Jan. 17 to Mar. 14, 1930, 2 injections bismuth and 7 injections mercury salicylate.	Fourth.....	2.1	15	140	do.....	3 days....	119
Sept. 11, 1928, to Jan. 8, 1929, 5.35 grams neoarsphenamine, 24 mercury rubs, and 4 doses bismuth; Mar. 13 to May 22, 1929, 3.6 grams neoarsphenamine; July 10 to Oct. 23, 1929, 6.3 grams neoarsphenamine.	Fifth.....	2.55	15	170	3 injections of mercury bichloride.	14 days..	165

## SULPHARSPHENAMINE

None (?) <sup>1</sup> .....	Intravenous: Mar. 12, neoarsphenamine, 0.3 gram.						
	Mar. 18, neoarsphenamine, 0.45 gram.						
	Intramuscular: Apr. 2, sulpharsphenamine, 0.6 gram.	0.6			None.....	15 days.....	(?)

<sup>1</sup> Native of Guam with no medical history.

In all but three of the above cases there is a history of recent prior injections of from 3 to 14 doses of neoarsphenamine in periods ranging from 10 to 34 days, with varying amounts of the drug averaging from about 70 to 180 milligrams per day over the period comprising the current course of treatment. Some of the patients had also received mercury or bismuth, and in some cases no concurrent treatment was recorded. One of the three cases having less than three injections of neoarsphenamine in the current course of treatment had had an arsenical dermatitis about eight months previously which occurred during a course in which the patient received 4.8 grams of neoarsphenamine over a period of 35 days, averaging approximately 137 milligrams per day. The remaining two cases, the one in which the dermatitis occurred following a 0.45-gram dose of neoarsphenamine and the sulpharsphenamine case, were both natives of Guam with indefinite medical histories.

A glance at the above table and the tables in the two preceding articles on this subject shows that in the vast majority of the cases of arsenical dermatitis the patients had received dosages in excess of that recommended by the Bureau of Medicine and Surgery circular letter, Serial No. 492-1929. Paragraph 10 of this letter follows:

*"Dosage of arsphenamines.*—It has been pointed out that the larger the dosage of arsphenamines employed the greater the liability to complications. At present smaller doses of arsenic are employed, and the therapeutic effect from the more conservative dosage has been just as good as in former days, when larger doses of the arsphenamine were used. As a general statement, 100 mg of a bismuth compound with 0.45 gm of neoarsphenamine should be given once a week. Rarely, if ever, should more than 0.6 gm of neoarsphenamine be given at one dose. A total of 4.5 gm of neoarsphenamine is considered sufficient to be given in one course or without a rest period."

It will be noted that a total of 4.5 grams given once a week in 0.45-gram doses over a period of 10 weeks would average a little less than 65 milligrams per day. It is not known how many cases have received more than this amount without any untoward effects, but it is interesting to note that of the 36 cases in which this information was recorded the average milligrams per day received by the patient during the course was over 200 in 1 case, from 150 to 199 in seven cases, from 100 to 149 in seventeen cases, from 70 to 99 in 9 cases, and 41 in 1 case.

*Clinical manifestations in cases of dermatitis exfoliativa.*—Among the cases occurring in 1930, there was one in which headache was stated to be a prodromal symptom. In another case symptoms appeared 5 days after the seventh dose, in which there were general malaise, sore throat, cough, headache, aching of muscles, fever, and

the skin showed a rapidly fading macular syphilis, followed in 13 days by the macular exanthem becoming dusky red. In another case there was a history of the palmer and planter surfaces of the hands and feet peeling off after the seventh injection of his previous course and two or three weeks prior to the end of the last course there was itching of the hands and feet. In another case there was a history of a previous attack of exfoliative dermatitis from April 12 to September 7, 1928 (148 sick days). In two other cases the dermatitis was superimposed on psoriasis. In the case that followed the single 0.45-gram injection of neoarsphenamine the patient reported eight days following the dose with swelling of the face and arms, erythema, eyes injected, followed by chill and fever, followed later by desquamation. In the sulpharsphenamine case the patient reported, 15 days after the dose, with fever and chilly sensations, followed by swelling of face, arms, and ears, and the eyes became injected, with desquamation following 3 days later. In the other four cases the dermatitis began and progressed to exfoliation without premonitory symptoms or signs.

Signs and symptoms noted at the time of onset or early in the course of the dermatitis were as follows:

*Neoarsphenamine*.—Psoriasis condition became worse, the eruption spread to all parts of the body, and the scale and crust became thick; erythema, which progressed rapidly, became in 5 days a well-developed dermatitis exfoliativa; headache, which was followed 10 days later by itching skin with dry flaking scales on hands and face and a burning sensation of face; 4 days later skin of hands, face, and feet began to peel; scaling of forehead and some rash on face spread to arms and legs and itched slightly; general rash most developed on dorsal surface of forearms; headache and general malaise followed in 4 days by large blisters on face, hands, and feet with considerable edema of face; erythema of forearms and ankles with fever, followed later by rash spreading over entire body and extremities with edema of hands, face, and ankles, the formation of small blebs and some exudation; generalized slightly itching rash with a tendency to scale formation; general malaise, sore throat, cough, headache, aching of muscles, fever; skin showed a rapidly fading macular syphilis; 13 days later macular exanthem became dusky red; itching of hands and feet; swelling of face and arms, erythema, eyes injected, chill and fever.

*Sulpharsphenamine*.—Fever, chilly sensations, swelling of face, arms, and ears; eyes injected.

*Arsphenamine*.—No cases of dermatitis attributable to arsphenamine were reported in 1930.

*Neoarsphenamine*—(*Case histories*).—A patient who was exposed September 1, 1928, developed a rash and adenopathy December 8, in

which a dark-field examination from a spot of rash on the abdomen showed numerous typical *Treponema*. The Kahn test on December 11, 1928 was 4 plus. He received from December 11, 1928, to January 8, 1929, 8 injections of neoarsphenamine (5.35 grams), 24 mercury rubs, and 4 doses of potassium bismuth tartrate (0.4 gram); from March 13 to May 22, 1929, 5 injections of neoarsphenamine (3.6 gram); and from July 10 to October 23, 1929, 8 injections of neoarsphenamine (6.3 gram). On February 10, 1930, he was admitted to the sick list with a diagnosis of psoriasis, which began in a very mild form in December. At the time of admission the rash predominated over chest and abdomen, also discrete on extremities and about face and scalp. Lesions were sharply circumscribed, red, scaly, elevated, and of various shapes and sizes. There was no itching. The condition did not respond to treatment and the patient was transferred to a naval hospital for disposition. There was a history of a very few small lesions of psoriasis that were first noted at a flight examination two years previously. About one year previously the lesions increased in size and number, and during the last month the eruption had become generalized and some grown into large patches. There was no other complaint. At the time of admission to the sick list the scalp margins and eyebrows were involved; hands and feet showed no lesions. He was given ultraviolet-light treatment. Urine and Kahn tests were negative on February 20, 1930, and lesions were disappearing slowly. March 31 very little improvement was noted, and patient was started on a course of neoarsphenamine for antisyphilitic and antipsoriasis effect, as follows: April 1, 0.3 gram; April 4, 0.45 gram; April 8, 0.6 gram; April 11, 0.6 gram; April 15, 0.6 gram; a total of 2.55 grams; and he received 0.01 gram of mercury bichloride on April 3, 7, and 10. No improvement was noted following this the fourth course of arsenical treatment, so antisyphilitic treatment was discontinued and the patient was placed on X-ray treatment. On April 29, 1930, the condition became worse. The eruption spread to all parts of the body and the scale and crust became very thick. This condition was treated with chrysarobin ointment with some improvement.

A medical survey was held on May 19, 1930, in which it was reported that the man's enlistment was to expire in about a month and that he did not wish to reenlist at that station. The psoriasis at that time was almost as severe as at the time of admission to the hospital three months previously, and treatment beyond the date of expiration of enlistment would have become necessary. In view of this the patient was transferred to a naval hospital in the United States for further treatment, where, upon arrival, it was noted that the lesions were slightly better in that the crusting was less, though there was a generalized skin lesion present. The scalp was covered



with a thick, dry, yellowish crust; the remaining skin of the body was covered with the same characteristic rash, most marked on the extremities about elbows and knees. There were glands palpable in the neck and at the elbow. The underlying skin was red and tender, with no cracking, burning, or itching. The impression at this time was that the condition was psoriasis superimposed by dermatitis exfoliativa. The urine, blood chemistry, and Kahn test were negative. He was given sodium thiosulphate by mouth and local application of bland ointments. By June 30 he was scaling profusely. No change in areas involved. By July 28 the scaling was slightly reduced and there was slow improvement. August 15 the areas involved decreased in size and the crusting and scaling was decreasing rapidly. September 15 the skin was clear except areas at the elbows and knees, where small areas with silvery scale remained. The patient was carried under a diagnosis of dermatitis, exfoliativa (antiluetic neosalvarsan), until October 11, 1930, when he was discharged to duty well, 179 days after the last dose of the fourth course of neoarsphenamine.

A patient was admitted to a naval hospital as with syphilis (also psoriasis) on December 23, 1929. The blood Kahn test on December 27, 1929, showed 4 plus. On December 28, 1929, he was given an intravenous injection of 0.3 gram of neoarsphenamine, and 0.6-gram injections on January 7, 14, 21 and 28, and February 4 and 11. The dilution of each injection was 0.1 gram to 2 c c of water. During the course he received eight intramuscular injections of bismuth at weekly intervals. On February 17, 1930, the patient developed an erythema which progressed rapidly, and five days later he had a well-developed dermatitis exfoliativa. The laboratory reports were as follows: February 12, blood Kahn positive, 4 plus. February 24, urine: Albumin, negative. February 25, Ven den Bergh (qualitative), negative. February 28: White blood count, 12,800; polymorphonuclears, 83 per cent; lymphocytes, 17 per cent. The patient was placed under treatment with sodium thiosulphate, intravenously, colloid baths, and cathartics, etc. The time of recovery is not stated on the report.

A patient was exposed April 4, 1930, at Norfolk, Va., and a diagnosis of syphilis was established on May 1, 1930, by reason of a 4 plus Kahn test. His first course of treatment consisted of four 0.6-gram injections of neoarsphenamine and four injections of bismuth (1 cc each), starting May 7, 1930. From the report it appears that the fourth and last injection of neoarsphenamine was administered May 28, though the dates of each injection are not stated. Headache was stated to be a prodromal symptom, and 10 days following the last injection of neoarsphenamine, or on June 7, the patient com-



plained of itching skin. There were dry, flaking scales on the hands and face and a burning sensation noted in the face. The urine was negative for albumin and casts. On June 11 the rash on the face, hands, and feet became markedly worse and started to peel off, and the patient was transferred to a naval hospital for treatment on June 17. At this time the patient showed a marked dermatitis over face, hands, legs, and body which was peeling off rapidly, leaving a moist raw surface, especially on the face. Also a reddish maculopapular rash was present over the body, which faded easily on pressure, and was smooth to feel but elevated. The patient had a red tongue, his throat was not injected, and he felt well; the physical examination was otherwise negative. Treatment with calamine lotion applied locally was begun, but discontinued on June 25, when the skin was peeling off in large pieces, and the patient was placed in 5 per cent bicarbonate soaks. He complained of excessive weakness. On July 2 the patient was improving; the skin practically all peeled off, kept moistened with olive oil. Boric acid and argyrol were applied to the eyes. The bicarbonate soaks and olive-oil treatments were continued with the condition improving.

July 24 sun-ray exposures were begun and continued daily. August 1 the red blood count was 3,335,000; hemoglobin 60 per cent; white blood count, 15,400. On August 4 there was an infection in the exterior auditory canal which was treated with warm hydrogen peroxide and phenol in olive oil (2 per cent). The Kahn test on August 13 was negative. September 5 the small areas of secondary infection on the skin surface had healed, and on September 19 the patient was granted 20 days' leave. He returned from leave October 7 and was discharged to duty, well, on October 10, 1930, after 115 days in the hospital (or 135 days after the last injection of neoarsphenamine).

A patient was admitted to a naval hospital July 27, 1927, with loss of appetite and sore throat. A generalized rash appeared the following day, and the diagnosis of syphilis was established by 4 plus Kahn tests on July 28, August 2, and August 15, 1927. There was a history of a penile sore in 1923 for which he received local treatment and the sore healed rapidly. No arsenical treatment was given him prior to 1927. From July 27 to August 26, 1927, he received 5 injections of an arsenical compound and 19 inunctions of mercury. From August 11, 1927, to April 12, 1928, he received seven injections of an arsenical compound. The arsenical compound in both of the above courses was presumably neoarsphenamine. The dates and dosages of each injection are not recorded, but on April 12, 1928, the patient was admitted with a diagnosis of eczema and transferred to a naval hospital, where the diagnosis was changed and recorded in

the medical history as trichophytosis (feet) and dermatitis exfoliativa (body), but the case was carried through 148 sick days under the diagnosis of trichophytosis only, which probably accounts for the fact that the arsenical dermatitis was not reported as an "arsphenamine" reaction in 1928. Sodium thiosulphate by vein was given for the dermatitis; the amount was not recorded. This admission terminated September 7, 1928, when the patient was discharged to duty "much improved."

No antiluetic treatment is reported as having been given the patient from April 12, 1928, to June 4, 1929, when he received his third course between the latter date and July 31, 1929, consisting of six injections of an arsenical compound and an unknown number of mercury inunctions. No ill effects are recorded as having occurred following this third course. On December 14, 1929, he was admitted with a diagnosis of chancroid and discharged to duty the same date under treatment, and on January 13, 1930, the Kahn test was 4 plus. From January 17 to March 14, 1930, he received two injections of bismuth (1 cc each) and seven injections of mercury salicylate (1 grain each). On May 20, 1930, he was readmitted with a diagnosis of syphilis, at which time there was a generalized maculopapular vesicular rash on the body and continuous pain in the right arm (previous injury). He was transferred to a naval hospital for further observation and treatment. On May 26, 1930, the Kahn test was negative, and on this date he was given 0.3 gram of neoarsphenamine, and injections of 0.6 gram were administered on June 3, 6, and 10. Three days after this fourth dose of the fourth course of arsenicals (June 13) the patient developed a severe exfoliative dermatitis over the entire body, the duration of which was 119 days. Kahn tests were 4 plus on July 16, 2 plus on July 11, and 1 plus on September 6. Twenty-six doses of sodium thiosulphate were administered intravenously from June 17 to September 19, 1930. Kahn tests were negative November 25, 1930, and January 13 and June 17, 1931. Complete report of clinical manifestations, etc., were not included in the report of this the second attack of exfoliative dermatitis in the case of this man.

A case in which the initial infection occurred in New York, N. Y., on June 1, 1929, was diagnosed syphilis by positive dark-field examination. Treatment was started at once, the patient receiving six injections of salvarsan and six of mercury ( $\text{HgCl}_2$ ), completing the course at another station by receiving two more injections of neo-salvarsan of 0.9 gram each and two of mercury succinimide of one-third grain each, completing the course on July 19, 1929. The second course extended over the period from September 6 to November 1, 1929, and consisted of a total of 6.3 grams of neosalvarsan and  $2\frac{1}{3}$

grains of mercury succinimide, the average dose of neosalvarsan being 0.9 gram. The third course was given from December 18, 1929, to January 29, 1930, and consisted of six injections of neosalvarsan, each dose being 0.6 gram. One week after completing this course there was a scaling of the forehead and some rash on his face. The urine was negative. The scaling increased and a rash appeared on his arms and legs which itched slightly. There were also mucous patches in the mouth. The patient was transferred to a naval hospital for treatment on February 13, 1930, and the progress and time of recovery were not reported.

A patient who was exposed November 1, 1929, at Canton, China, developed initial lesions November 15, dark-field examination of which was positive for *Treponema pallidum* November 18, and he was admitted to the sick list on that date with a diagnosis of syphilis. On November 18, 1929, he was given an intravenous injection of neoarsphenamine of 0.3 gram; November 26, 0.45 gram; December 3, 0.6 gram; and 0.9-gram injections on December 10, 17, 24, 31, 1929, and January 7, 1930, a total of 5.85 grams for the course. On January 15, or eight days after the last dose of neoarsphenamine, the patient had a general rash, which was most developed on the dorsal surface of the forearms. He was given 1 gram of sodium thiosulphate intravenously on January 15 and 16. On January 17 the skin eruption was very much worse, blebs having begun to form. The intravenous therapy was discontinued. The temperature range from January 15 to 18 was from 102 to 103, and pulse 130. Urine was negative for albumin. By January 25 the patient was very uncomfortable, desquamation had begun, and there were many spots where the tender new skin was exposed. By January 31 many abscesses had developed, one on each groin, one on the scrotum, one on the back, one on the neck, one under each arm, and one on the abdomen and chest, all of which were incised and drained. The temperature continued to rise to 100 daily. By February 2 the patient was improving, the skin much better, and the temperature 99, and by February 14 the temperature was normal. The patient was still in bed with routine care at this time. The condition continued to improve with the patient gaining weight, and he was up and about by March 1. On March 3 the Kahn test was negative. By March 8 the patient felt fine and desired to return to duty. At this time the skin was practically clear except on the scalp, arms, and neck, where it was clearing rapidly, and by March 17 was practically clear. On this date, as the patient apparently would be better satisfied with some light work to do, he was sent to duty with the understanding that work was to be light. This case had 61 sick days.

A patient exposed July 15, 1929, at Matagalpa, Nicaragua, developed a lesion on the scrotum which was positive for *Treponema*

*pallidum* on August 20, 1929. On August 28, 1929, he was given an intravenous injection of 0.3 gram of neoarsphenamine, and he was given 0.9 gram injections on September 4, 11, 18, 25, and October 2, 1929, a total of 4.8 grams for the first course, and he received six mercurial inunctions during this period. His second course was begun April 18, 1930, with an intravenous injection of 0.6 gram of neoarsphenamine. The day following this injection, or about 24 hours after the first dose of the second course, the patient reported to the sick bay complaining of headache and general malaise. He had a marked rash all over the body. The urine was normal. He was given forced fluids and 1 gram of sodium thiosulphate intravenously every other day. By April 23 the patient had large blisters on the face, hands, and feet and considerable edema of the face. The urine showed a slight trace of albumin at this time. By April 26 the patient was slightly improved, the edema subsiding, the body clearing, and the urine normal. April 30 the patient was desquamating, and there was continued improvement until June 2, 1930, when the patient was discharged as fit for duty, after 44 sick days.

A patient exposed May 3, 1930, at New York, N. Y., developed a primary lesion on frenum, dark-field examination of which was positive for *Treponema pallidum*. He was admitted with a diagnosis of syphilis for record only and discharged to duty the same day, under treatment. He was given 0.6 gram of neoarsphenamine and 2 grains of bismuth salicylate on June 4, 9, and 14, 1930. On June 15, or 24 hours after this third treatment of the first course, the patient had an erythema of the forearms and ankles and a temperature of 100° F. The rash later spread over the entire body and extremities, with edema of the hands, face, and ankles, the formation of small blebs, and some exudation. The Dickens' test showed arsenic in the urine for four days after admission. The urine otherwise was negative. The blood count and pressure were normal. A branny desquamation, with peeling of the hands and feet, began about the fourth day. He was given sodium thiosulphate in 1-gram doses intravenously daily for four doses, forced liquids with sodium bicarbonate (grains XV), and ephedrine hydrochloride (grains  $\frac{3}{8}$ ) t. i. d. On June 22 he was transferred to a naval hospital for further treatment. At the hospital it was noted that the skin was scaling, crusting, fissured over the entire body, painful and cracked on the arms, and there was edema of the ankles and eyelids, and the hearing was reduced bilaterally. He was put to bed with proctoclysis of Fisher's solution, argyrol to the eyes, ichthyol-zinc oxide ointment to skin, and the ears syringed. From June 24 to July 11 he received 16 grams of sodium thiosulphate by vein in 1, 1½, and 2 gram doses. On July 11 the skin was much improved and there was no more weeping.

July 31 a large infected sebaceous cyst on the right side of the back was incised, treated, and dressed, and August 19 an abscess on the back of the neck was incised and treated. September 1 there was a marked swelling and induration of the left side of the neck, with an operative wound that contained only a few drops of pus. On September 30 the patient had fully recovered from the exfoliative dermatitis and was discharged to duty on October 2, 1930, after 109 sick days.

A patient exposed in Manila, P. I., February 23, 1930, developed an initial lesion March 27, dark-field examination negative. Kahn blood reaction was 4 plus on April 15, 1930. There was slight epitrochlear and inguinal adenopathy, but no secondaries. For his first course of arsenical treatment he received 14 injections of neoarsphenamine, beginning April 19, and ending June 9, 1930, and during this period he received 33 mercurial inunctions. The first injection of neoarsphenamine was given April 19 (dose, 0.4 gram), and 0.6-gram injections were given on April 24 and 28, May 1, 5, 9, 12, 15, 18, 21, and 29, and June 2, 5, and 9, a total of 8.2 grams given over a period of 51 days, or approximately 1.12 grams per week. The dilution in each injection was 0.9 to 20, and the rate of injection was reported as three to five minutes. On June 18, or nine days after the last dose of neoarsphenamine, the patient reported to the sick bay with a generalized slightly itching rash, with a tendency toward scale formation. He was given 1 gram of sodium thiosulphate intravenously immediately, and 1 gram by mouth t. i. d. was ordered. The lesions gradually became worse, until on June 25 he had a very marked formation with profuse desquamation, most marked on the forearms and face. He was put to bed, and colloid baths and mild ointment applied to soften scales. One gram of sodium thiosulphate was given intravenously daily and 1 gram by mouth with no apparent improvement. Desquamation increased, and by July 1 there was a secondary infection on forearms, pinnae, and nose. The temperature had been normal. The patient was transferred to a hospital ashore in Tsingtao, China, on July 1, for treatment. There was slow improvement, with lesions becoming less scaly and pruritis less severe, and on July 30 he was returned to his ship much improved. He was discharged to duty on August 4, 1930, with lesions still present but fading, after 47 sick days.

A patient who contracted syphilis in Hong Kong, China, April 5, 1930, diagnosis established by positive dark-field examination, suffered an attack of exfoliative dermatitis following his first course of treatment in which he received a total of 3.45 grams of neoarsphenamine given in seven doses one week apart and mercurial inunctions twice a week. This case is described in the United States Naval Medical Bulletin of April, 1931, page 233. The case had 38 sick days.

A patient infected May 1, 1930, at Norfolk, Va., developed an intraurethral chancre and later a maculopapular eruption and a 4 plus Kahn blood test. His first course of treatment, from June 26 to August 15, 1930, consisted of an unknown number of mercurial inunctions and six injections of 0.45 gram and two injections of 0.6 gram of neoarsphenamine, a total of 3.9 grams for the first course. The second course, from September 5 to October 29, 1930, consisted of an unknown number of mercurial inunctions and one injection of 0.33 gram, five injections of 0.45 gram, and two injections of 0.6 gram of neoarsphenamine, a total of 3.78 grams for the second course. On November 25, or 27 days after the last dose of the second course, he was admitted to the sick list on account of an exfoliative dermatitis and transferred to a naval hospital for treatment. The health record states that about the 1st of August, 1930, following seven injections of neoarsphenamine, the skin of the palmar surface of the hand and plantar surface of the feet peeled off. This cleared up, and the patient continued on antiluetic treatment. About two or three weeks prior to the end of the last treatment he noticed an itching of the hands and feet. This was followed by desquamation of the skin. The only parts of the body affected were the lips and mouth, where there were several patches that appeared about one week prior to admission to the hospital. At the time of his admission the palmar surface of the hands and plantar surface of the feet were markedly desquamating and the patient complained of itching of both hands and feet. There was a small patch of what appeared to be trichophytosis on the right leg. There were several slightly raised patches of the mucosa at the corners of the lips, on both buccal surfaces and on the hard palate. Dark-field examination of a lesion on the lip was positive for *Treponema pallidum*. No sodium thiosulphate was administered. The dermatitis was treated with local cleanliness and applications of calamine lotion, and the patient received eight injections of bismuth, given twice a week. By December 30, 1930, the condition had practically disappeared and the patient was discharged to duty on this date after 35 sick days, or 62 days after the last injection of neoarsphenamine.

A case developed an exfoliative dermatitis after a single injection of 0.45 gram of neoarsphenamine. The patient, a native of Guam, gave a positive blood Kahn reaction and was given an intravenous injection of 0.45 gram of neoarsphenamine, diluted 1 to 20, and given by the syringe method very slowly. Eight days later the patient reported with swelling of the face and arms, erythema, eyes injected, followed by chill, temperature of 102, and later by desquamation. Sodium thiosulphate 1 gram was given intravenously on the third and tenth days and 15 grains by mouth twice a day. The report states that the patient was still desquamating at the time of

the report, and no further information has been received concerning the case.

*Sulpharsphenamine*—(*Case histories*).—An intramuscular injection of sulpharsphenamine was responsible for one case of exfoliative dermatitis during 1930. The patient, a native of Guam, gave a positive blood Kahn reaction and was started on a course of arsenical treatment, as follows: First dose, March 12, 1930, 0.3 gram neoarsphenamine; second dose, March 19, 1930, 0.45 gram neoarsphenamine; third week, missed; third dose, April 2, 1930, 0.6 gram sulpharsphenamine intramuscularly. The sulpharsphenamine was diluted to a strength of 0.2 gram to 1 c c of water. Fifteen days later the patient had a temperature of 102° F. with chilly sensations, followed by swelling of face, arms, and ears, and the eyes became injected. This condition was followed in three days by desquamation. Sodium thiosulphate (grains 15) was given twice a day by mouth. The case was desquamating at the time of the report (May 3, 1930), and no further information was received.

#### MISCELLANEOUS EFFECTS FOLLOWING THE ADMINISTRATION OF ARSENICAL COMPOUNDS

*Damage to the liver.*—Aside from the one case in which slight jaundice appeared as a symptom of relatively minor importance in connection with the manifestations classed as vasomotor phenomena, jaundice was reported only in two instances, both of which followed the use of neoarsphenamine. The two cases follow.

A case in which the report does not give the time and place of infection, but states that diagnosis was made by clinical and laboratory findings, was given for his first course of treatment 0.3 gram of neoarsphenamine intravenously on October 8, 1930, 0.45 gram October 15, and 0.6 gram on October 22. On October 20 he received 1 c c of bismuth intramuscularly. The third injection of neoarsphenamine, given on October 22, consisted of 0.6 gram in 12 c c of sterile distilled water, and the rate of injection was one and one-half minutes for the 12 c c. Three and one-half hours after this injection the patient exhibited symptoms of general malaise with marked headache. His temperature was 104.4° F., pulse 130, and respiration 34. The white blood count was 8,500, and the differential was polymorphonuclears 71 per cent, lymphocytes 25 per cent, eosinophils 2 per cent, and large mononuclears 1 per cent. Examination of urine on October 21 was negative for albumin and sugar. The specimen of urine passed three hours after administration showed a faint trace of arsenic, while the 6, 11, 13, 20, and 25-hour specimens were positive for arsenic. The 26-hour and following specimens were negative for arsenic. Treatment in this case consisted of

administration of ephedrine, active catharsis, and sodium bicarbonate by mouth and rectum. On October 29, 1930, jaundice developed and the patient was transferred to a hospital ship for further treatment. Upon admission to the hospital ship the only symptoms recorded that were referable to the arsenical poisoning were icterus and coated tongue. Clinical laboratory examination showed Van den Bergh qualitative direct reaction immediate, with quantitative 4.2 mg and icteric index 32. He was placed on fat-free diet, sodium phosphate each morning, forced fluids, and under observation. On November 7 antiluetic treatment was resumed by intramuscular injections of bismuth. He was discharged to duty status November 18 under treatment for both gonococcus infection of urethra, and syphilis. The jaundice had entirely cleared by this date, or 27 days after the third injection of neoarsphenamine.

A patient exposed in Ponce, Puerto Rico, April 6, 1930, developed a small lesion on the mucous surface of prepuce April 26, dark-field examination of which was positive for *Treponema pallidum*. He was admitted for record with a diagnosis of syphilis and discharged to duty under treatment. From April 22 to May 6, 1930, he received three injections of neoarsphenamine (doses not stated) and an unknown number of mercury rubs. While under this treatment numerous deep-seated ulcers discharging quantities of pus appeared around corona, for which routine treatment for chancroid infection failed to produce improvement, and the patient was transferred to a hospital ship for further observation and treatment on May 12, 1930. At this time the report states, in addition to the above, that the patient had continuous headaches for the past two weeks. The ulcers were treated locally and the patient was given further antiluetic treatment, as follows: Neoarsphenamine, 0.3 gram May 13, 0.45 gram May 23, and 0.6 gram May 27; bismuth, 0.1 gram May 23 and May 30. The dilution of the last dose of neoarsphenamine was 0.9 to 21 cc of water and the rate of injection was two minutes for the dose. About four days after this the sixth dose of neoarsphenamine, symptoms developed in which there was general malaise, scattered itching rash over the body and icterus. The report shows the results of Dickens' test following the injections given on May 13 and May 27, respectively, as follows: May 13, first 3-hour specimen positive, second 3-hour specimen negative, seventh-hour specimen negative; May 27, first 3-hour specimen 4 plus, second 3-hour specimen 2 plus, seventh-hour specimen negative. The following is taken from progress notes: May 13, urinalysis normal. May 19, headache persists. Sinuses clear, nose negative. Eye grounds—disks normal; no fundus pathology. May 22, Kahn negative. May 27, headache less, lesions healing. May 28, malaise, temperature 99.4° F., pulse 84, respiration 18. Urinalysis negative except for small amount of



mucus and few sheets of epithelium. June 1, tongue coated, some icterus present, with sparsely scattered itching rash over body. June 2, icterus index 37. Van den Bergh qualitative direct immediate. White blood count, 9,200. Differential: Polymorphonuclears, 68 per cent lymphocytes, 30 per cent; eosinophiles, 1 per cent; large mononuclears, 1 per cent. Red blood count 4,300,000; hemoglobin, 85 per cent. Urinalysis negative except for occasional squamous epithelial cells and occasional calcium oxalate crystals. Diagnosis changed to poisoning, neoarsphenamine, acute (antisyphilitic) (liver damage), and arsenicals discontinued. Placed on elimination, fat-free diet, sodium phosphate each morning, and forced fluids. Sodium thiosulphate given on June 1, 3, 4, 5, 7, and 11. June 3, red blood count, 4,300,000; hemoglobin, 85 per cent. Urinalysis negative except for occasional squamous epithelial cells and occasional calcium oxalate crystals. June 8, Van den Bergh qualitative direct immediate. Quantitative 3 mg per 100 cc. Icterus index 53. General physical examination negative except that icterus persisted with some itching of skin at times, and on June 19 the patient was transferred to a naval hospital ashore because of probable protracted convalescence. Examination upon admission to the hospital revealed a coated tongue, some icterus present, with sparsely scattered itching rash over body. At the hospital he received six daily intravenous injections of sodium thiosulphate, 1 gram each, beginning June 19, and the patient was discharged to duty July 28, 1930, or 62 days after the last dose of neoarsphenamine.

*Aplastic anemia.*—In 1930 there was one death reported from this cause and one nonfatal case reported as agranulocytosis.

There was one death to be included under this heading during the year 1930, the condition occurring in a man aged 22 after the administration of the twelfth dose of neoarsphenamine in the treatment of syphilis. This case is described in detail by Biello and Love in the UNITED STATES NAVAL MEDICAL BULLETIN of January, 1931, page 76, under the title "A Case of Anhematopoiesis Following Neoarsphenamine Therapy in the Treatment of Syphilis."

Cases in which the blood picture indicates any degree of injury to the bone marrow and in which there are no other prominent or outstanding manifestations, such as exfoliative dermatitis, polyneuritis, etc., are included in groups under this heading, though the following case, reported in 1930 as agranulocytosis, may not be considered to have developed to a degree sufficient to justify its designation as an aplastic anemia.

*Agranulocytosis.*—A patient who was exposed May 20, 1930, at Panama City, Panama, developed a small penile lesion June 1. Facilities for blood test were not available until July 5, 1930, at

which time a Wassermann test was double plus, rechecked double plus on July 11. Up to this time, according to the report, the patient had received no antiluetic treatment, and his first course was started July 17, 1930, with a 0.45-gram injection of neoarsphenamine, followed by 0.6-gram injections on July 23, 30, and August 6. He also received one-half grain doses of mercury salicylate on each of the above dates (four  $\frac{1}{2}$ -grain doses in all). The dilution in each of the neoarsphenamine injections was 1 to 10, and the rate of injection was about one-half minute for the dose. Symptoms of reaction began about 24 hours after the fourth injection of neoarsphenamine (August 7, 1930), in which there was general aching, loss of appetite, unable to sleep, slight red flush to skin over entire body with no itching. The white blood count had dropped to 2,100, with a total absence of polymorphonuclears. Complete blood counts were not reported. The report states that the patient was given 10 grams of sodium thiosulphate intravenously on August 8, 1930 (no further treatment is shown on the report). The Kahn test was negative on September 1, and he was returned to duty on September 3, 1930, after 27 sick days. Treatment was continued with bismuth and mercury.

In the reports covering the years from 1925 up to and including the year 1928, no cases of aplastic anemia were reported. The first case to be included in the statistical grouping of arsenical reactions is that of a case terminating in recovery that occurred about December 6, 1928 (described by Roberts in the UNITED STATES NAVAL MEDICAL BULLETIN of July, 1931, p. 441). There were two fatal cases reported in 1929, and in 1930 there was one fatal case of aplastic anemia and one nonfatal case of agranulocytosis. All of these cases followed the use of neoarsphenamine. Excluding the nonfatal case which occurred in 1928 and the one case of agranulocytosis which occurred in 1930, we have three fatal cases of aplastic anemia occurring during the two years 1929 and 1930. In these two years there was a total of 162,334 injections of neoarsphenamine administered which gives a ratio of 1 death from aplastic anemia to 54,111 doses of neoarsphenamine.

*Herxheimer reactions.*—It is difficult to determine a line of demarcation between a certain type of vasomotor phenomena reaction and a Herxheimer reaction. However, two reactions occurred in 1930 that appear to be of the Jarisch-Herxheimer type and are included here under the heading of "Herxheimer Reactions."

A patient who was exposed August 26, 1930, developed a maculopapular nonitching rash over the body—Wassermann test 2 plus, and Kahn test 4 plus. Treatment was begun in October, 1930, with an intravenous injection of neoarsphenamine consisting of 0.45 gram dissolved in 20 cc of sterile distilled water. Urinalysis was negative

before and after administering the neoarsphenamine and the kidneys showed a normal excretion of the drug. About six hours after this the first injection of neoarsphenamine, the patient began to feel somewhat dizzy and weak. He reported to the sick bay, where it was found that his temperature was 104° F., pulse 100, and respiration 22. The patient had a typical secondary rash, and at this time the rash was very much more pronounced. He did not complain of any headache, had no nausea and vomiting, no abdominal cramps or diarrhea. He was given 15 minims of adrenalin intramuscularly, and his temperature became normal at the end of 6 hours, or 12 hours after the injection of neoarsphenamine, and he was sent back to duty feeling well. There were no other untoward symptoms.

A patient who was exposed in Manila, P. I., on February 1, 1930, developed a slow-healing penile lesion with signs and symptoms pointing to the possibility of its being luetic. On March 5, 1930, he was given an intravenous injection of neoarsphenamine consisting of 0.4 gram dissolved in 12 cc of water. About six hours after the treatment was administered the patient complained of nausea, occipital headache, and fever. Examination revealed a temperature of 104.2° F., pulse 140, and respiration 28. There was an extensive maculopapular syphiloderm. The injection was the first the patient had ever received; all usual precautions were carried out; urine examined and found negative for albumin; a laxative was given the night before and breakfast was omitted the morning of the injection. The treatment for the reaction was symptomatic and palliative and sodium thiosulphate, one dose of 0.4 gram, given intravenously. The temperature and pulse rate remained high for about 24 hours, when both gradually returned to normal; recovery was uneventful, and patient was up and about in five days. Since the reaction the patient has received eight injections, the first course, a total of 4.3 grams of neoarsphenamine; urine has remained free from albumin, and there have been no subsequent reactions noted.

*Reactions of minor importance.*—The following reactions were observed in two patients, both of whom received 0.45-gram injections of neoarsphenamine, and in both cases it was the second injection of the second course of neoarsphenamine treatment, the first course having been completed in January and April, 1930, respectively. Neither patient had ever experienced any reaction from neoarsphenamine before. Both patients complained immediately after the injection of severe pains in the arm radiating upward from the site of injection. Within an hour following the injection both patients experienced chills of moderate severity. The temperature of both was about 100° F. The pains increased in severity. The arms in

which the neoarsphenamine had been injected became considerably swollen and were very red and feverish. Sharp pain was experienced in both cases when slight pressure was made over the veins on the ventral surface of the arm, giving the impression in each case of an acute phlebitis. Both patients were put to bed within an hour following their treatment; wet dressings of 10 per cent magnesium sulphate were employed, together with the use of hot-water bottles. No evidence of kidney involvement was noted, the urine in each case showing but faint, if any, positive trace of albumen on careful analysis. Subjective symptoms had largely subsided within 24 hours, and the men were returned to duty, but a slight brawniness of tissues and moderate tenderness at the sites of injection persisted. Both men have received three injections of neoarsphenamine of other lot numbers since September 9, 1930, employing the same dosage, using the other arm for injection, without evidence of kidney injury and with no further reaction.

Four mild reactions occurred on the same day aboard the same ship following the administration of neoarsphenamine. Two hours after the injections the four men concerned had symptoms varying from chill with temperature of 100° F. to headache with temperature of 100° F. Two of the four men received a 0.3-gram dose as a first injection in a second or third course, one a 0.6-gram dose as the sixth injection of his fourth course, and the other a 0.3-gram dose for a provocative Kahn test. No further information was received to cover these four cases.

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## THE VENEREAL DISEASE PROBLEM IN THE UNITED STATES

### PART II. A PRELIMINARY REPORT ON THE RESULTS OF VARIOUS METHODS OF TREATMENT IN ACUTE GONORRHEA

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#### INTRODUCTION

Late in 1929, during a privileged and stimulating association with Commander G. R. W. French and Lieut. Commander James E. Potter, Medical Corps, United States Navy, I was permitted to make a prepublication study of Doctor Potter's excellent paper on the mercurochrome-dextrose treatment of gonorrheal infections prepared in collaboration with Dr. F. H. Redewill, of San Francisco (8).

Essentially this method contemplates the intravenous administration of a course of injections of 1 per cent aqueous mercurochrome dissolved in freshly prepared 50 per cent sterile dextrose solution, to the exclusion of the usual topical antiseptic urethral irrigations or

injections. The toxicity of the mercurochrome is markedly decreased by the dextrose, and it is important to note that Redewill and Potter have found that the potency of the aqueous solution of mercurochrome is definitely increased by irradiation with the mercury-arc light without increasing its toxicity in any way (8). They recommend supplementary physiotherapeutic measures, such as diathermy and infra-red radiation, most effectively administered by the new "cold" neon-light applicator devised by them (8).

*The modified Potter-Redewill treatment.*—While working with Doctor Potter at the receiving ship, San Francisco, at his suggestion and under his supervision (7), a short consecutive series of patients with acute gonorrhea was treated, each man being placed at bed rest and receiving a course of five intravenous injections of 1 per cent aqueous mercurochrome in 50 per cent dextrose (7 cc doses), alternating every other day with five intramuscular injections of sterile milk (3 cc doses) without any urethral medication, thus modifying the original Redewill-Potter treatment by the introduction of the factor of nonspecific protein shock. Reactions were carefully watched and tabulated. A rapid disappearance of the discharge was noted in every case, and far earlier evidences of clinical cure were obtained than in any of the cases treated by the usual injection method. Satisfactory follow up of these cases was not feasible.

The empirical results of this sequence were so encouraging, however, that it was determined upon change of station to run a properly controlled series of cases of acute gonorrhea in an effort to determine the comparative therapeutic efficiency of certain modern treatment methods and to evaluate the possibilities of the modified Potter-Redewill method. A detailed report of such a consecutive controlled series in the South China Patrol is presented below.

#### A CRITICAL REVIEW OF 52 CONSECUTIVE CASES IN THE SOUTH CHINA PATROL

In conducting a study of this sort a peculiar relative advantage is enjoyed over civilian facilities for control and follow up by reason of the disciplinary nature of the naval organization. This is partially offset, however, by the factor of high exposure hazard, especially on foreign stations, acting upon a selected age and sex group.

*General plan of series.*—It was decided at the outset to run a series of approximately 50 consecutive, uncomplicated, original admissions for acute gonococcal urethritis. An effort was made at early detection, so that treatment might be instituted before the invasion of the posterior urethra. Readmissions, chronic cases, and cases compli-

cated on admission were excluded<sup>1</sup>—otherwise the consecutive routine was undisturbed.

This series was to be divided into three numerically equal treatment groups. Every fourth case in each treatment group was to be arbitrarily designated a control case (except in Group I, where the eighth case was the first control).

A careful follow-up routine was observed. All previously discharged patients were examined every week for signs of recurrence, and any exacerbations or complications properly recorded.

Data were entered daily on specially prepared forms, similar to the tables included in this report, after careful personal observation of individual cases.

Provocation was adopted only in those cases becoming complicated during treatment.

#### TREATMENT METHODS

(I) *The classical injection method (Group I).*—To sponsor any particular method of treatment of acute gonorrhea is admittedly to enter one of the most disputed and controversial fields in medicine.

No medical contribution of recent years, however, has done more to clarify issues, to explain moot points, or to define the true rationale of treatment than Pelouze's excellent monograph on gonorrhea in the male—"Unquestionably the most neglected field in all of medicine" (4).

What are the essential features of the classical injection method?

(A) Prohibitions: The best ally for cure is an untraumatized mucous membrane in a patient who drinks no alcohol, has no sexual excitement, and who receives no large doses of gonococcus vaccines. Strenuous physical exertion is forbidden, but ordinary diet and ordinary activity rarely influence the course of the disease (4).

(B) Injection medication: The object is to gently apply to the urethral mucosa substances which have the power to stimulate the patient's curative responses (4).

If the general problem of the proper treatment of acute gonorrhea is a much-mooted topic in medical circles, the advocacy of some special injection medicament is even more certain to arouse objections of injured slight or even of active antagonism.

Pelouze (4) (5) lists the drugs most commonly used as follows:

Silver nucleinate.	Neutral acriflavine 1:5,000.
Argyrol, 5 per cent.	Potassium permanganate 1:5,000.
Neosilvol.	Mercurochrome, ½ per cent.
Protargol, ½ per cent.	Silver nitrate 1:10,000.

<sup>1</sup> For instance, cases 4 a and 11 a (see Table I) were omitted because of epididymitis on admission; case 21 a (Table II) for the same reason; cases 41 a and b were a reinfection and a recurrence, respectively, and consequently not included (Table III).

Highly astringent substances are omitted as unfit for use in acute gonorrhea, since they tend to obscure the clinical picture by removing the evidences of infection rather than curing it (5).

The pathology of the disease and years of empirical clinical observation seem to show beyond a doubt that local medicinal treatments are of value only for their action on the infected mucosa and not for their ability to kill gonococci.

(C) Treatment procedure: According to Pelouze (4), a simple treatment plan might be outlined as follows:

(a) Acute anterior urethritis.—(1) Do the 2-glass test (at least a 2-hour urine specimen).

(2) Gently cleanse the urethra (1:5,000 potassium permanganate),

(3) Give an anterior injection of 3 cc of any one of the usual injection medicaments, retaining the solution (penis clamp) for 5–10 minutes.

(4) Continue this treatment twice a day until there is no discharge and the first glass contains only a few shreds; then reduce the frequency of treatment, gradually increasing the interval, provided the discharge is controlled.

(5) The above dietary, activity, and sexual prohibitions are observed throughout.

(b) Acute anteroposterior urethritis.—(1) Discontinue all local treatment if the posterior urethra is involved until: (a) Bladder comfort is regained (a dram each of camphorated tincture of opium and sodium bromide may be administered as a mild sedative); (b) glass 2 is clear and glass 1 is only hazy (although both glasses may remain cloudy).

(2) Avoid a full bladder and lifting strains.

(3) After the hyperacute symptoms subside: (a) Irrigate the bladder daily or on alternate days with 1:5,000 potassium-permanganate solution (3½ feet hydrostatic pressure)—the Janet lavage.

(4) Resume anterior injections.

(5) Gentle prostatic massage should be given twice a week; infection no longer exists when the prostatic secretion contains not more than 3 to 5 white blood corpuscles to the high-power field (4).

(6) No instrumentation.

The important question of proofs of cure will be fully discussed below.

Active treatment procedure: All cases in Group I, except controls, were treated as outlined above in the discussion of the classical injection method with the following modifications:

(1) Proper observance of the various prohibitions as to sexual, dietary, and physical activity was insured by disciplinary restriction to the ship and supervision.

(2) Except in extreme instances, all cases were ambulatory, but duties were carefully modified to avoid lifting strains, and scrotal suspensories were insisted upon.

(3) Anterior injections of 5 per cent mild silver protein were given as indicated in the above discussion, but the suggested bladder irrigations were not.

(4) As an adjuvant, oil of santal (0.6 cc) was administered three times daily.

(5) Absolutely no self-treatment was permitted.

Management of controls (Group I): The excellent studies of Pelouze and Gonzales in the fluctuant hydrogen-ion concentrations of the urethral fluids (6) have shown that, whether normal or gonorrheal, the urethra possesses the power of sudden increase in alkalinity (to pH 7.53) immediately following the passage of either an alkaline or acid urine. They found that the intraurethral injection of hypertonic solutions might unfavorably influence the course of the disease and that efforts to alter the pH of either the urine or the urethral tissues by oral medication were obviously futile.

Consequently, in the management of control cases of this group and of the controls of Group II as well (*vide infra*) it was determined to use an isotonic injection fluid which would duplicate the mechanical factors involved in anterior medication without any actual therapeutic or irritant effect upon the urethral mucosa. Physiological solution of sodium chloride (U. S. P.) was taken as the basis of this control solution, and its pH adjusted by titration and colorimetrically to 7.53 against phenolsulphonphthalein test solution (U. S. P.) as the indicator.

The control cases in this group, therefore, received exactly the same general care as the cases under active treatment, including oil of santal by mouth. However, no actual intraurethral medication was given—the cleansing injection of potassium permanganate was omitted, and the isotonic control injection solution was injected anteriorly at regular treatment times.



TABLE I

Method of treatment—Group I	Case	Clinical progress										
		Admitted	Glass 2 clear			Complication or recurrence	Actual sick days	Total days active treatment	Proof of cure			
			Glass 1 clear	with shreds	Glass 1 clear				Sound and urethral smear	Sound and prostatic smear	Liberty	Provocative
		Day of disease							Day of disease			
Injection.....	1	Jan. 2, 1930	17	41	53	Intercurrent syphilis; epididymitis, Dec. 26, 1930.	---	62	69	76	83	---
Do.....	2	Jan. 5, 1930	13	37	46	-----	---	53	60	67	74	---
Do.....	3	Jan. 6, 1930	25	46	56	Epididymitis, Jan. 21, 1930.	10	63	70	77	90	85
Do.....	4	Jan. 7, 1930	16	35	47	-----	---	54	61	68	75	---
Acid. epididymitis.		do										
Injection.....	5	Jan. 23, 1930	22	50	85	Exacerbation, Feb. 6, 1930; recurrence, May 29, 1930.	15	101	108	115	129	122
Do.....	6	do	15	33	47	-----	---	54	61	68	75	---
Do.....	7	Jan. 24, 1930	14	37	44	-----	---	56	63	70	77	---
Control.....	8	Feb. 18, 1930	31	66	91	-----	---	104	111	118	125	---
Injection.....	9	Feb. 20, 1930	13	47	72	Epididymitis, Nov. 17, 1930.	17	77	84	91	98	---
Do.....	10	Feb. 24, 1930	26	45	66	Recurrence, Mar. 4, 1930.	47	73	80	87	101	94
Do.....	11	Feb. 25, 1930	13	44	61	Epididymitis, Mar. 25, 1930.	8	68	75	82	98	89
Complicated on admission.	ac.	Mar. 19, 1930; epididymitis Mar. 20, 1930.										
Control.....	12	Mar. 20, 1930	35	64	93	-----	---	101	108	115	122	---
Injection.....	13	Mar. 22, 1930	7	17	29	-----	---	40	47	54	61	---
Do.....	14	Mar. 26, 1930	25	93	123	Epididymitis, Apr. 3, 1931.	52 33	130	137	144	158	151
Do.....	15	Apr. 17, 1930	17	42	56	-----	---	63	70	77	84	---
Control.....	16	Apr. 19, 1930	39	71	97	Exacerbation, May 7, 1930.	---	108	115	122	134	127

(II) *The modified injection method (Group II).*—In his excellent paper (2) Jeck cites four principles fundamental to the successful treatment of gonorrhea: (a) Gentleness, (b) avoidance of overtreatment, (c) recognition that gonorrhea is a self-limited disease, and (d) patience.

His suggestions as to treatment represent a rational, modernized modification of the time-honored injection method. What are the essential features of this modified treatment?

(A) Hyperacute anterior and anteroposterior urethritis.—(1) Do the 2-glass test. Glass 1 will be turbid; glass 2, hazy.

(2) Prohibitions: (a) Absolutely no local treatment, (b) only needed fluids, (c) no irritant beverages (ginger ale, alcohol), (d) no excess condiments, (e) no sexual stimulation, (f) no unnecessary exercise.

(3) Medical: (a) Oil of santal, minims 10 (0.6 cc) three times daily with restricted fluids, or sodium bicarbonate, grams 2, three times

daily with forced fluids; (b) A good suspensory, to avoid epididymitis.

(B) Acute anterior gonorrheal urethritis.—(1) Do the 2-glass test. Glass 1 is hazy; glass 2, clear.

(2) Prohibitions: Same as above except local treatment.

(3) Medical: (a) Once daily, an anterior injection of acriflavine 1:5,000; retain for one minute; (b) After one week (if no improvement) alternate acriflavine with strong silver protein (one-fourth per cent) or mild silver protein (10 per cent) twice daily (retain for three minutes), and then three times daily (retain for five minutes); (c) After one week (if improved, i. e., both glasses clear) suspend all treatment, and pass a No. 20 F sound to the cut-off muscle; (d) after two days make and stain an urethral smear for gonococci, and pass a No. 24 F sound to the cut-off muscle; (e) after two more days examine prostatic smear for gonococci; (f) after a week's probation pass a No. 26 F sound clear into the bladder and examine urethral smears on two succeeding days.

(C) Acute posterior urethritis.—According to Jeck (2), the trend in the treatment of acute gonorrhea is toward the employment of injections rather than irrigations, and the Janet system of forced irrigation is now discontinued by some of our foremost urologists, due to danger of trauma and seminal vesiculitis (2) (11).

In case of an acute posterior urethritis: (1) Daily anterior injections are continued until (a) there is slight, if any, urethral discharge; (b) glass 1 contains shreds and is cloudy and glass 2 is hazy with fewer shreds; (c) no gonococci are found in the urethral smear.

(2) Self-treatment is discontinued, and the physician treats the patient twice a week.

(3) Gentle prostatic massage is given every five days.

(4) If urine does not clear on massage alone, occasionally gently pass a small sound to the cut-off muscle (irrigate before and after with a suitable antiseptic, e. g., potassium permanganate 1:5,000).

(5) If both glasses remain clear for a week and the discharge has ceased or been reduced to a "morning drop," test for infectiousness, i. e., examine urethral and prostatic smears for gonococci, and do a complement-fixation test.

Active treatment procedure: All cases in Group II, except controls, were treated exactly as outlined in the above discussion of the modified injection method, except that absolutely no self-treatment was permitted and restrictive supervision was exerted.

Management of controls (Group II): The controls in this group received the same general care at the same time as the cases under active treatment, including oral medication, except that the isotonic

control injection fluid was substituted for the active medicament intraurethrally. Naturally, no instrumentation was done in the presence of an active disease process.

TABLE II

Method of treatment—Group II	Case	Clinical progress										
		Admitted	Glass 1 clear with shreds			Complication or recurrence	Actual sick days	Total days actual treatment	Proof of cure			
			Glass 2 clear	Glass 1 clear	Glass 1 clear				Sound and urethral smear	Sound and prostatic smear	Liberty	Provocative
			Day of disease					Day of disease				
Modified injection.	17	May 3, 1930	16	44	54	-----	-----	61	68	75	82	----
Do.....	18	May 5, 1930	13	35	44	-----	-----	51	58	65	72	----
Do.....	19	May 6, 1930	17	44	53	-----	-----	60	67	74	81	----
Control.....	20	do.....	33	67	88	Epididymitis, Aug. 30, 1930.	10	96	103	110	124	117
Modified injection.	21	do.....	19	40	51	-----	-----	58	65	72	79	----
Complicated on admission.	Acid	June 15, 1930; epididymitis, June 16, 1930.	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Modified injection.	22	June 18, 1930	14	33	47	-----	-----	54	61	67	74	----
Do.....	23	June 23, 1930	15	41	52	-----	-----	59	66	73	80	----
Control.....	24	do.....	37	63	94	Exacerbation, Aug. 12, 1930.	-----	105	112	119	133	126
Modified injection.	25	June 24, 1930	42	55	63	Prostate, July 29, 1930....	10	70	77	84	98	91
Do.....	26	June 26, 1930	11	35	43	-----	-----	50	57	64	71	----
Do.....	27	July 1, 1930	12	36	45	-----	-----	52	59	66	73	----
Control.....	28	July 3, 1930	41	66	87	-----	-----	98	105	112	119	----
Modified injection.	29	July 29, 1930	13	34	41	-----	-----	48	55	62	69	----
Do.....	30	July 30, 1930	12	37	45	-----	-----	52	59	66	73	----
Do.....	31	do.....	34	54	61	Epididymitis, Aug. 7, 1930.	26	68	75	82	96	89
Control.....	32	Aug. 1, 1930	39	70	94	-----	-----	103	110	117	124	----

(III) *The modified Potter-Redewill method (Group III).*—Active treatment procedure: It was contemplated in this series to supplement the original intravenous mercurochrome-dextrose method of Redewill and Potter (8) as outlined in the introduction with the factor of nonspecific protein shock and the best features of the modified injection method (2).

Accordingly, all cases of Group III, except controls, were treated as follows:

(1) The excellent prohibitions and restrictive supervisions of the first two groups were closely adhered to.

(2) Each case was given a course of five intravenous injections of 5 cc of freshly prepared 1 per cent aqueous mercurochrome in 50 per cent dextrose, alternating on alternate days with five epifascial (in-

tramuscular) injections of 3 to 5 cc of sterile evaporated milk. No intraurethral medication was given until the completion of these injections, but oil of santal (0.6 cc) was administered orally three times daily. Careful tabulations of febrile reactions were kept. As far as possible, patients were ambulatory, although during reactions bedrest was prescribed.

(3) Upon the completion of this course a marked subsidence or actual disappearance of the discharge was uniformly noted and a course of active intraurethral medication (acriflavine 1:5000) instituted, following the essential technique outlined by Jeck (2).

Management of controls (Group III): Obviously, due to the combined treatment methods adopted in this group, the management of controls presented a slightly different problem than that met with above. The general care and oral medication administered was identical to that of the cases under active treatment. The first control, however (see Table III, case 36), received intravenous mercurochrome and dextrose only, omitting milk, followed by anterior intraurethral injections of isotonic control injection solution at regular treatment times to reproduce the mechanical factors incident to actual intraurethral medication.

The second control case (No. 40), on the other hand, was given sterile milk alone intramuscularly, omitting mercurochrome and dextrose, similarly followed by anterior intraurethral injections of isotonic control solution.

The third control case (No. 44) received exactly the same treatment as the regularly treated cases of Group III, including active intraurethral medication (Jeck technique), except that the sterile milk injections were omitted.

The fourth control case (No. 48) was given the regular treatment of Group III, except that intramuscular milk was substituted for intravenous dextrose mercurochrome.

It was considered useless to run controls receiving the active intraurethral medication (Jeck treatment) only, since, due to the sequential nature of the series and consequent comparability of the cases, every actively treated case in Group II (see above) could properly be regarded as a control for this phase of the problem.

TABLE III

Method of treatment—Group III	Case	Clinical progress										
		Admitted	Glass 2 clear			Complication or recurrence	Actual sick days	Total days actual treatment	Proof of cure			
			Glass 1 clear with shreds	Glass 1 clear	Sound and urethral smear				Sound and prostatic smear	Liberty	Provocative	
		Day of disease					Day of disease					
Modified Potter-Redewill.	33	Aug. 7, 1930	7	17	24	-----	-----	31	38	45	52	----
Do.....	34	Aug. 14, 1930	16	27	36	Epididymitis, Dec. 1, 1930	27	43	50	57	64	115
Do.....	35	Aug. 16, 1930	9	20	28	-----	-----	35	42	49	56	----
Control.....	36	Aug. 22, 1930	21	46	53	-----	21	60	67	74	81	----
Modified Potter-Redewill.	37	Sept. 11, 1930	11	23	31	-----	-----	38	45	52	59	----
Do.....	38	Sept. 24, 1930	8	19	27	-----	-----	34	41	48	55	----
Do.....	39	Oct. 7, 1930	10	19	30	Periurethral abscess, Nov. 17, 1930.	10	37	44	51	65	58
Control.....	40	Oct. 14, 1930	23	54	66	-----	20	74	81	88	95	----
Modified Potter-Redewill.	41	Nov. 5, 1930	11	21	30	-----	-----	38	45	52	59	----
Readmitted reinfection.	-----	do.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Readmitted recurrence.	-----	Nov. 10, 1930	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Modified Potter-Redewill.	42	Nov. 28, 1930	8	19	29	-----	-----	36	43	50	57	----
Do.....	43	Dec. 13, 1930	19	34	41	Periurethral abscess Dec. 22, 1930.	7	48	55	62	76	69
Control.....	44	do.....	22	49	61	-----	-----	69	76	83	90	----
Modified Potter-Redewill.	45	Jan. 8, 1931	7	15	23	-----	-----	30	37	44	51	----
Do.....	46	Mar. 28, 1931	8	17	24	-----	6	32	39	46	53	----
Do.....	47	May 6, 1931	9	21	28	-----	9	35	42	49	56	----
Control.....	48	May 7, 1931	25	47	59	-----	25	67	74	81	88	----

## CRITERIA OF CURE

In the pronouncement of cure the excellent procedure advocated by Jeck (2) was followed in all groups for all cases. Active treatment was continued a full week after both glasses became clear and the patient symptomless. Following this, a 3-week probationary period was prescribed and restriction to the ship rigidly maintained during this time. At the end of the first week a sound (No. 24 F) was passed to the cut-off muscle and urethral smears obtained and examined for two successive days. At the end of the second week a No. 26 F sound was passed into the bladder itself and both prostatic and urethral smears examined for gonococci on successive days. If negative, the man was taken off the venereal restricted list and permitted to go on liberty. In the natural course of events, particularly on a foreign station, this ordinarily meant some alcoholic and possibly even occasional sexual indulgence. Weekly examinations were made for a month following the granting of liberty. In addition,

continuous follow up to detect recurrence and reinfection was maintained.

Provocation was considered unwise as a routine procedure (10), and one-half per cent silver-nitrate solution was employed only in cases becoming complicated in the course of treatment, due to the greater possibility of undetected latent foci.

#### ANALYSIS OF DATA

*The series in general.*—(A) Progress under treatment: In tabulating data, clinical progress was divided into three stages and each expressed in treatment days.

The first stage comprised the period from the day of admission through the hyperacute and early acute stage until the second glass became clear.

The second stage included the period from the time the second glass became clear until the first glass became clear with shreds.

The third stage included the period from the time the first glass became clear with shreds until a week beyond the time that it and hence both glasses became clear.

In Tables I, II, and III clinical progress is sequentially indicated in days of disease—in case 1, for example, glass 2 became clear on the seventeenth treatment day after admission; the second stage ended on the forty-first treatment day; and glass 1 became clear on the fifty-third day of treatment; active treatment was discontinued on the sixty-second day of the disease; proof of cure following test by liberty was obtained on the eighty-third day after admission.

For the most part the cases were ambulatory, but actual sick days—i. e., days absent from duty—were recorded as true numerical totals in order to give some idea of the comparative inactive rate.

A continuous follow-up of all cases was vigorously maintained and all complications, recurrences, reinfections, and exacerbations properly recorded with their dates.

*Comparison of treatment methods (Table IV).*—(A) Average progress under treatment: It is apparent from Table IV (summary of data) that the average clinical progress for all three stages was most rapid in Group III in cases treated by the modified Potter-Redewill method. The modified injection method was consistently better than the time-honored injection method except in the first stage. Similarly, the controls of Group III progressed more rapidly than those of other groups.

(B) Average total duration of treatment: As a natural sequel to consistently better clinical progress, the average total duration of treatment of Group III cases was far less than that of other groups—only two-thirds of the time required by Group II and half that of Group I.

The controls of Group III also showed a lower average of total days active treatment than those of other groups.

In the interest of greater clarity and more concise comparative presentation, these data have been graphed. (Table V.) The abscissa of five days was taken empirically as the apparent origin of all curves to designate the average duration of the hyperacute stage in all groups.

(C) Sick days: The modified injection treatment group (II) had the fewest sick days and a lower inactive average, bettering Group III in this respect. The explanation of this lies in the fact that men in Group III were turned in more frequently because of reactions from mercurochrome or protein shock, and also because, although very efficacious, the Redewill-Potter method does not entirely prevent complications. Group I had the highest actual number of sick days and the highest inactive average.

It is interesting to note that Group III controls had an unusually high inactive rate, largely due to mild reactions and malaise, necessitating admission to the sick list.

(D) Follow up (complications, recurrences, etc.): Group I led all others in total and average complications and Group II was lowest. However, the controls of Group I had fewer complications than those of Group II.

As might have been expected, epididymitis was the most usual complication.

In common with earlier observers (1) (3) (9), it was found that although nonspecific protein shock was remarkably effective in controlling the discharge and shortening early treatment time, it certainly did not prevent complications.

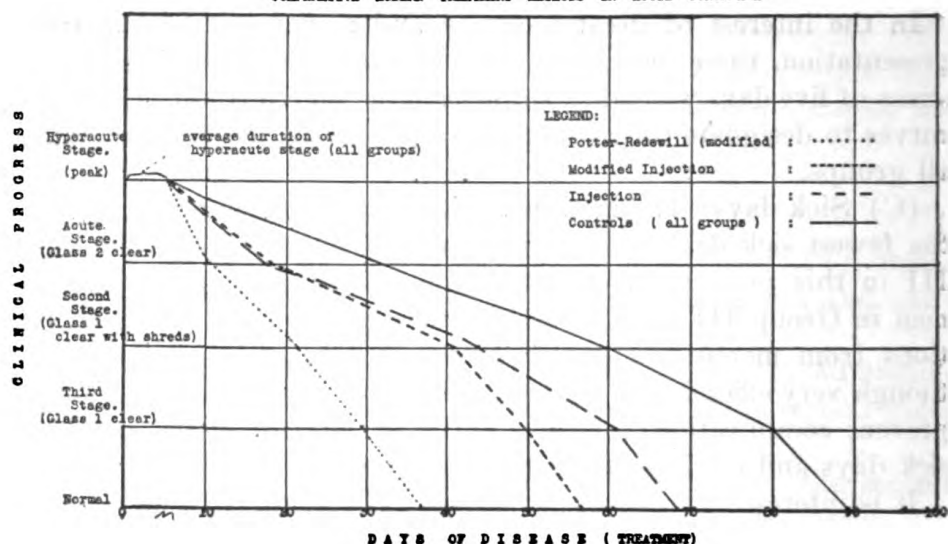
TABLE IV.—*Summary of data*

Method of treatment	Number of cases	Clinical progress								
		Average days first stage	Average days second stage	Average days third stage	Total complications	Average complications	Total sick days	Average sick days	Total days active treatment	Average days active treatment
		Days of disease								
Group I.....	13	17.5	26.46	16.77	5 epididymitis, 2 recurrence, 1 exacerbation.	.615	182	13.23	894	68.77
Group II.....	12	18.16	22.5	9.25	1 epididymitis, 1 prostate...	.166	36	3.0	683	56.91
Group III.....	12	10.25	10.83	8.25	1 epididymitis, 2 periurethral, abscess.	.25	59	4.91	437	36.41
Controls (all groups).	11	31.45	28.81	20.00	1 epididymitis, 2 exacerbation.	.27	76	6.91	985	89.54
Controls, Group I.	3	35.00	32.00	26.66	1 exacerbation.....	.33	-----	-----	313	104.43
Controls, group II.	4	37.5	31.00	24.25	1 epididymitis, 1 exacerbation.	.50	10	2.5	402	100.50
Controls, Group III.	4	22.75	26.25	10.50	-----	-----	66	16.5	270	67.50



TABLE V

COMPARATIVE MODERN TREATMENT METHODS IN ACUTE GONORRHEA



## COMMENT

The essential limitations of such a study as this are self-evident, and no illusions are entertained as to the conclusiveness of any therapeutic deductions made on the basis of so small a series. Consequently, no unnecessary enthusiastic claims are made—the cases and methods are presented simply and objectively in the belief that whatever results have been obtained will be found at least stimulating and suggestive and not wholly without significance.

## SUMMARY

1. A critical résumé of 52 consecutive, controlled cases of initial acute gonococcal urethritis, comparatively treated according to the classical injection, modified injection, and modified Potter-Redewill methods, is presented.

2. Average clinical progress was most rapid in cases treated by the modified Potter-Redewill method, and the average total duration of treatment for this group was correspondingly shortest—36.41 treatment days, as compared with 56.91 for the modified injection method; 68.77 for the classical injection method; and 89.54 treatment days for controls of all groups.

3. The modified injection method had the fewest sick days (36) and the lowest inactive rate (3 days per man in this group).

4. Epididymitis was the most usual complication—the modified injection method had the fewest complications (1 in 6).

5. Results of this study would seem to indicate that the modified Potter-Redewill treatment effectively controls the discharge and



shortens early treatment time, but does not prevent complications and has a slightly higher inactive rate than the modified injection method.

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#### A MEDICAL SURVEY OF KOREA (CHOSEN)<sup>1</sup>

##### CLIMATE

The physical configuration of Chosen gives it a climate of almost unsurpassed excellence and there are no extremes of heat and cold to guard against. Because of the length of the peninsula the winter at the north is considerably colder than at the south. At Shingishu it opens earlier, and spring is 30 days later than at Fusan. The winters are cold and dry, while the summers, though hot, are tempered by sea breezes. January is the coldest month, the mean temperature being 15° C. at the north and 35° C. at the south. The northland is sometimes covered with snow from September to March, but with bright, clear days, and still, frosty nights. The Yalu and Tumen Rivers are frozen over from 3 to 4 months of the year and the Han from 2 to 3 months. The ice is usually thick enough to permit the passage of any army with impedimenta, except possibly heavy artillery and tanks. For nine months of the year one can customarily count upon bright blue, unclouded skies from the Yalu to the Korean

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<sup>1</sup> From the report of the military attaché, Japan (No. 6161), dated Mar. 15, 1932.

**Straits.** The winters in the south are bright and mild, with a certain crispness about them.

The hottest month is August, with a mean temperature at Seoul (Keijo), the capital, of about 75° F. for summer and 33° for winter. In the north the mean summer temperature is about 72° F, while in the south it is about 77° F. The mean of the east coast is from 2° to 4° higher than that of the west coast in the same latitude during February and March, the reverse being the case during the period from April to July. From October to March northerly winds prevail; in April and September they are variable, and from May to August they are usually southerly.

The rains are well distributed during the year; the average rainfall is 36 inches and during the summer season 22 inches. Irrigation is necessary only for the rice crop. The rainy season occurs in July–August on the northeast and the west coasts and April–July on the south coast, the annual rainfall in these localities being 35, 42, and 30 inches, respectively. It is dry on the west coast from September to January; on the south in February, where the rain is more evenly distributed throughout the year than elsewhere; and on the northeast coast from April to August. The fierce hot summer, mid-July to mid-September, is trying, but not unhealthy.

Fogs frequently occur on the northeast coast in summer, and occasionally at the beginning and end of winter; on the west coast from March to July, and on the south from April to August.

#### GENERAL HEALTH CONDITIONS

The Korean's ideas of sanitation and hygiene are low. Their homes are still filthy hovels, sealed tightly in winter and, more often than not, overcrowded, aiding greatly in the spread of diseases. Their wells are little short of pestholes and have often been the cause of epidemics. The food in the shops and the public eating places are dangerous to foreigners. The streams are often polluted by the incessant washing of the white robes, the national costume of the men. This gives them a cleaner appearance on the outside, but the Koreans are frugal in the use of water otherwise, and, in fact, have a determined hostility toward it. The best description of their villages likens them to a pigpen, and there is a vast difference between the Japanese sections of the towns and the purely native quarters. The Japanese are still doing wonders in sanitation to change the above, but the ignorance and laziness of the natives prevent much progress. Though nearly all of the larger cities have modern waterworks and other sanitary measures, the Korean still lives contentedly amidst filth and frowsy smells.

## PREVAILING DISEASES

(a) *Epidemic diseases*.—It is interesting to know that, in spite of Chosen's contiguity to Chinese and Russian territory, the country has never been troubled by invasions of pestilences. Nevertheless, visitation by other epidemics, such as cholera, smallpox, typhoid fever, dysentery, etc., was very frequent and sometimes in a most virulent form. The people in general had little idea of sanitation and, being swayed by superstition, refused in many cases to be medically treated. Great difficulty was consequently met with in working for the prevention of epidemics, but recent progress in Korean social psychology has brought with it a salutary change in this respect.

Cholera has long been familiar to the peninsula. It is said that in the year 1895 over 600,000 perished of the plague in the frontier districts, and again in 1902 about 10,000 fell victim to it in the city of Keijo alone, not to mention other places. The disease usually enters from abroad, especially from China, and varies greatly in activity. In 1919 and 1920 malignant cholera invaded the land and notwithstanding the preventive measures taken by the authorities, raged furiously, the number of cases reported in 1919 being 17,000, of which 11,000 proved fatal, and 24,000 in 1920, with a death roll of 13,000. Yet compared with former days it can be said that the malady has considerably diminished in severity.

In 1922 the plague raging in North China invaded west Japan early in September. The situation being very alarming, immediate action was taken at the seaports to assure prevention of its entry. Some cases, however, were discovered on the western frontier of Chosen, so the quarantine station at Shingishu at once busied itself with examination of every passenger from the Chinese side of the Yalu, as well as with injection of anticholera vaccine into all people in the neighborhood, and as the result of these efforts only 40 genuine cases in all were reported. In the summer of 1926 the disease, breaking out in North China, invaded the frontier districts along the Yalu, and, in spite of all efforts to stamp it out, 252 cases were reported, of which 159 ended in death.

Smallpox formerly prevailed more or less throughout the year. This was mainly because of the time-honored superstition among the people that this particular disease must be accepted as an act of God, so they did not attempt in any way to ward off its attack. In 1905 the Korean Government issued vaccination rules and aimed at their universal enforcement, but no good results were obtained, and numerous cases of the disease were reported every year. On the establishment of the present régime, therefore, great efforts were put forth to combat the disease, and police and sanitary officials were enlisted to disillusion the populace of their old superstition

and to preach to them the saving virtue of vaccination. At the same time, large quantities of vaccine were distributed free, and for the vaccination of women, female operators were engaged. As a consequence, after 1913, cases of smallpox fell to between 300 and 500 a year. In the spring of 1919 the disease again broke out, producing upwards of 2,000 cases. In 1920 malignant smallpox invaded the land from countries adjacent, and vaccination was at once resorted to, as far as possible, but the disease ran a fatal course, with more than 3,500 out of 11,500 cases. In 1921 cases still reached the large number of over 8,300, of which 2,500 were carried off, but in the year following, even though it gave signs of prevalence in the spring, the authorities were able to hold it in check.

Typhoid fever is of yearly occurrence in the country, and many cases are reported every year. As the disease requires a certain period to develop, there is always a suspicion that its virus may be spreading before it is discovered, and this makes prevention more difficult. Each time this malady prevails the authorities dispense free to all applicants the preventive injection, while all medical agencies are encouraged to make extensive use of it.

As regards other epidemics, in view of their yearly appearance, similar precautions are always and everywhere taken by the authorities in the form of periodical house cleaning, strict control of food and drinks, early discovery and report of cases, general injection of preventive vaccines, bacterial examination of suspected cases, etc.

The table below indicates the number of epidemic cases during more recent years.

Year	Cholera	Dysentery	Typhoid fever	Small-pox	Eruptive typhus	Scarlet fever	Diphtheria	Paratyphoid
1919.....	16,991	1,521	3,239	2,146	841	125	276	660
1920.....	24,213	979	2,132	11,532	76	369	263	222
1921.....	1	978	2,535	8,316	73	717	238	300
1922.....	40	1,932	3,801	3,676	63	585	265	473
1923.....	-----	1,195	2,839	3,722	1,072	1,008	420	314
1924.....	-----	1,443	3,272	439	540	1,361	523	301
1925.....	6	2,030	5,005	699	225	634	513	474
1926.....	252	2,277	5,170	1,010	1,239	798	497	372
1927.....	-----	3,291	4,762	627	952	904	601	461

(b) *Endemic diseases.*—Of the so-called endemics, the more prominent are distoma, ankylostomiasis, and malaria, the most numerous cases being those of lung distoma. Besides these there are other contagious diseases present, such as tuberculosis, leprosy, itch, etc. For lepers a government leprosarium has been established on Shoroku-to, a small island off the southern coast of the peninsula, where a limited number of them are accommodated and segregated. Foreign missionary bodies have also extended their humanitarian

activity to this direction, and mission leper asylums are found in three southern towns—Fusan, Taikyū, and Junten. (Annual Report of the Administration of Chosen, 1927–28.)

Leprosy is another form of endemic disease in Chosen, and many lepers are to be met with, though mostly in the south. Though no accurate statistics are available, the number of cases in advanced condition is reported to be approximately 5,000, to say nothing of the incipient cases. These unfortunate mortals, wandering about the country spreading the invisible germs of their disease, present not only a most miserable sight but are a great menace to the public health. It was by a foreign missionary body that the first leper homes, three in number, were established in the south. The government in turn realized the need of making provision for lepers and drew up a plan in 1916 for their segregation. Shoroku-to, a small island off the coast of South Zenra Province, was selected as a suitable site, and the building of the new institution was started with special aid from the imperial charity funds and completed in 1917.

The island is noted for its mild climate. The leprosarium is situated in the hills and occupies a vast space of ground divided into two parts, one for males and one for females. At present more than 200 patients are being cared for in the institution. In order to keep the inmates from loafing, the able are employed in such work as they show capacity for. For the medical treatment of the lepers a new injection, called ethyl-ester of chaulmoogra oil, has been made use of since the winter of 1921, and with such encouraging results that the disease is no longer regarded as incurable, thus bringing a ray of hope into the lives of these unfortunate beings.

(c) *Contagious diseases*.—The following table, taken from the “Résumé Statistique de l'Empire du Japon,” forty-fourth year, published by the Bureau of Statistics of the Imperial Cabinet, shows the number of contagious diseases in Chosen and the number of deaths resulting therefrom:

Year	Asiatic cholera		Dysentery		Typhoid fever		Paratyphoid		Meningitis	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1918.....	0	0	1,124	268	3,752	704	1,144	92	0	0
1919.....	16,915	11,533	1,492	401	3,123	655	643	90	0	0
1920.....	24,229	13,568	974	253	2,140	422	220	23	0	0
1921.....	1	1	978	311	2,535	485	300	33	0	0
1922.....	40	23	1,932	529	3,801	768	473	52	0	0
1923.....	0	0	1,195	296	2,839	541	314	30	0	0
1924.....	0	0	1,443	386	3,273	567	301	16	53	26
1925.....	6	5	2,030	488	5,006	906	474	66	17	11
1926.....	252	159	2,277	594	5,174	805	372	33	12	5
1927.....	0	0	3,291	750	4,762	700	461	58	96	58

Year	Smallpox		Eruptive typhus		Scarlet fever		Diphtheria		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1918.....	330	111	108	23	125	12	333	107	6,916	1,317
1919.....	2,140	700	836	119	137	28	273	73	25,550	13,500
1920.....	11,532	3,614	78	20	371	106	264	60	39,808	18,075
1921.....	8,316	2,527	73	18	717	209	238	93	13,158	3,677
1922.....	3,676	1,160	63	20	585	139	265	101	10,835	2,792
1923.....	3,722	1,120	27	6	1,008	242	420	141	9,525	2,376
1924.....	439	85	540	94	1,361	340	523	185	7,933	1,609
1925.....	699	170	225	34	734	158	514	203	9,705	2,041
1926.....	1,010	237	1,239	136	798	135	497	191	11,631	2,295
1927.....	627	147	952	84	904	179	607	223	11,700	2,201

(d) *Cattle disease*.—Several forms of cattle disease exist in Chosen, some of them being introduced from adjacent Chinese territory and others originating in the peninsula itself, and the country suffers more or less from their visitation every year. Accordingly, in 1915 a preventive law was enforced, and in 1918 the serum laboratory established by the home Government was transferred to the Chosen administration. At the same time a number of serum stations, with veterinary surgeons in charge, were set up in important points along the frontier.

Rinderpest, a prominent form of cattle disease, has its permanent cradle on the Chinese side of the Yalu and Tumen, yet in the face of the ever-present possibility of invasion, especially during the long season of frost, nothing was ever done to prevent it until after the annexation. However, the preventive work since taken up has rendered its invasion less widespread than formerly. In 1916 the disease again crossed the frontier and 71 cases of it were reported, but in 1927 there were only 4 cases. As a preventive measure, enforcement of serum injection into animals in the affected district, isolation of the entire vicinity, close guard against animals going in and out, and early discovery of fresh cases, if any, were vigorously carried on by police and the people. All cattle shipped from Chosen to Japan are thoroughly examined before they are allowed to leave the country.

#### DEATHS

The following details were furnished by the Bureau of Census of the Japanese Government and are the latest figures obtainable:

	1927	1928		1927	1928
Infectious diseases:			Skin diseases:		
Male.....	17, 105	18, 103	Male.....	4, 264	4, 070
Female.....	14, 735	15, 692	Female.....	3, 814	3, 462
General diseases:			Digestive organ:		
Male.....	5, 780	5, 840	Male.....	35, 567	38, 898
Female.....	4, 616	4, 736	Female.....	31, 025	34, 040
Psychopathic diseases:			Intoxication:		
Male.....	4, 081	4, 067	Male.....	2, 652	2, 738
Female.....	3, 143	3, 038	Female.....	2, 225	2, 168
Diseases of nervous system:			Malformation and diseases peculiar to early infancy:		
Male.....	42, 479	44, 025	Male.....	1, 978	2, 205
Female.....	36, 275	37, 535	Female.....	1, 642	1, 959
Influenza:			Senile:		
Male.....	18, 688	20, 176	Male.....	10, 807	13, 773
Female.....	16, 738	17, 676	Female.....	10, 377	12, 928
Urogenital:			Accidents and suicide:		
Male.....	5, 295	5, 870	Male.....	4, 127	2, 148
Female.....	5, 199	5, 793	Female.....	2, 797	1, 395
Respiratory:			Beriberi:		
Male.....	28, 237	28, 539	Male.....	896	1, 018
Female.....	24, 875	24, 952	Female.....	568	703
Tumor:			Total:		
Male.....	337	437	Male.....	206, 090	218, 725
Female.....	437	387	Female.....	181, 653	192, 290
Circulatory:			Total.....	387, 743	411, 015
Male.....	9, 698	10, 674			
Female.....	8, 214	9, 121			
Motor organ:					
Male.....	3, 057	3, 166			
Female.....	2, 408	2, 432			

## MUNICIPAL, STATE, AND FEDERAL HEALTH ORGANIZATIONS

Until recently sanitation in Chosen was in a backward state, for the country had few native doctors possessed of modern knowledge and skill, and the sick were usually placed at the mercy of practitioners of the old Chinese school, or of witches or exorcists, instead of being rationally treated, while the lack of proper sanitation and even good drinking water gave constant rise to various infectious diseases. As medical agencies worthy of the name, there were but a few Japanese doctors and foreign medical missionaries practicing in Keijo and a few other towns.

Early in the protectorate period, therefore, the first step taken toward sanitary reform was the establishment of a modern hospital, called the Tai-Han I-in (Korean General Hospital), in Keijo. Dr. S. Sato, a celebrated surgeon in Japan at the time, was made head of it. On the advent of the present régime, further measures were taken for improvement of the existing system, and not only was the Government hospital (former Tai-Han I-in) enlarged but similiar organs were set up in the Provinces, public doctors were appointed to remote districts, special physicians engaged for circuit work in parts difficult of access, and a segregating station for lepers was established. Nor did the service along this line stop here, for care was taken that even those Koreans living in the remote borderlands might have medical facilities within easier reach of them.

The authorities next took in hand the matter of drinking water and made the construction or extension of waterworks possible in many of the chief towns; they also encouraged the digging of public wells throughout the land. At the same time a considerable sum of money

was yearly defrayed to permit of timely action being taken for prevention of epidemics, with the result that even smallpox, once so virulent in Chosen, is now far less the scourge it was, thanks to the fuller enforcement of universal vaccination, while rigid control over the disposal of impurities and other insanitary matters was constantly exercised for the sake of the public health. Meantime, various sanitary regulations relating to physicians, dentists, food and drinks, drugs, street and house cleaning, disinfection, etc., were drawn up and made effective as popular conditions called for them.

Although popular confidence in the central and provincial hospitals grew stronger as time went by, there still remained much room for their improvement, so the Government in 1919 drew up a plan for extension of its medical service, and the hospitals and medical force have since been greatly augmented. At present the number of Government hospitals is 31 and public doctors over 230. Besides these there is one hospital in Keijo maintained by the Chosen Chapter of the Japanese Red Cross Society.

Up to 1920 no sanitary experts were stationed in the Provinces for local investigation and prevention of epidemics, but in that year 1 expert and 2 assistants were appointed to each Province, and at the same time 30 more medical men were appointed to attend to people in the more remote parts of the country. As for quarantine at sea-ports, though at first Fusan, Jinsen, and Gensan were the only quarantine ports, it was extended to smaller ports, as they too were frequently threatened by the invasion of a pestilence. and quarantine officials are now stationed at Kunsan, Mokpo, Chinnampo, Seishin, and Shingishu, while the staff at each of the three premier ports has been enlarged.

Hygienic inspection is most indispensable in connection with the official control of foods, drinks, and drugs, so from 1913 onward the Provinces were gradually equipped with laboratories for chemical examination of these articles, and no Province is now lacking in such. Important articles subject to official inspection during 1927 totaled 35,530, of which 7,780 were declared unwholesome or injurious. Chief among the condemnations were 3,600 samples of patent medicines and 3,150 of beverages. Formerly no research work in epidemics, in spite of their presence in the country the whole year round, was attempted in the Provinces, but since the cholera invasion of 1920 a bacterial laboratory has been formed in every Province. The preparation of various prophylactic vaccines, however, is conducted by the one in Keijo only, and is distributed to various centers at a small charge or else free of cost.

In Keijo there is the Government Medical School for training both Japanese and Koreans in modern medical knowledge and skill. In 1930 it had a faculty of 105, regular and part time, and an en-



rollment of 351. (Source: Most of the above is taken from the "Annual Report of the Administration of Chosen, 1927-28.")

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#### SMALLPOX VACCINATION

Dr. Arthur E. Nichols, deputy health officer, St. Paul, Minn., states in a notice to the medical profession in the Monthly Bulletin of the Bureau of Health of the City of St. Paul, January, 1932, that "Since May, 1928, we have vaccinated for smallpox by the pressure method exclusively; shields and dressings are discarded entirely.

"We find this method a great improvement upon the old scratch custom. There are no more suppurating arms to dress nor unsightly scars. Percentages of takes compare favorably with the old method.

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#### HEALTH OF THE NAVY

The admission rate, all causes, based on returns for January, February, and March, 1932, was 465 per 1,000 per annum. The corresponding median rate for the first quarter, 5-year period, was 419. The general admission rate was slightly higher than expectancy, due to the greater than usual winter prevalence of common infections of the respiratory type and to the continuation of catarrhal fever in epidemic form which made its appearance during November and December last year.

The admission rate from disease was 428 per 1,000 per annum, and the 5-year median for the corresponding three months was 378. The admission rate from accidental injuries was 37, as compared with 40, the median or expected rate, representing experience in the preceding five years.

During the quarter, 186 cases of influenza and 996 of catarrhal fever were reported by shore stations in the United States. Of the cases diagnosed as influenza, 169 occurred at the United States marine barracks, Quantico, Va. This station reported, "Early in February the post was swept by an epidemic of severe influenza." Six cases appeared in January and 96 in February. Many of these were characterized by relapse, and in 10 instances otitis media was a complication. Peritonsillar abscess complicated four cases. The peak of the epidemic was reached the last week in February. In March, 67 cases were admitted, all of which were considered benign and without complications or sequelæ.

The United States naval training station, San Diego, Calif., reported that very good health conditions existed during the quarter. In January, 104 cases of catarrhal fever were notified; in February, 94; and in March, 45. One case of cerebrospinal fever developed at this station in February. The patient was transferred to the naval

hospital, San Diego, Calif., for confirmation of diagnosis and treatment.

With the exception of 124 cases of catarrhal fever, health conditions at the United States naval training station, Hampton Roads, Va., were exceptionally good. Three cases of chicken pox were reported—1 in January, 1 in February, and 1 in March. There were no other contagious diseases admitted during this period.

The United States naval training station, Great Lakes, Ill., notified 7 cases of catarrhal fever in January, 90 in February, and 23 in March. Only 85 cases of catarrhal fever occurred at the United States naval training station, Newport, R. I., during the quarter.

The admission rate, all causes, for forces afloat was 476 per 1,000 per annum. The median rate for the first quarter of the preceding five years is 390. The increase above the expected rate was due to the outbreaks of catarrhal fever which appeared on board several ships of the Navy during the winter months.

A list of ships reporting 34 or more cases of acute catarrhal fever is shown in the following tabulation:

Ship	January	February	March	Total
<b>Battle force:</b>				
U. S. S. Texas.....	81	10	7	98
U. S. S. New York.....	37	47	9	93
U. S. S. Arizona.....	16	65	6	87
U. S. S. Lexington.....	34	41	11	86
U. S. S. Maryland.....	26	41	16	83
U. S. S. Tennessee.....	24	45	6	75
U. S. S. West Virginia.....	36	21	16	73
U. S. S. Saratoga.....	17	40	14	71
U. S. S. Pennsylvania.....	21	34	7	62
U. S. S. California.....	40	12	9	61
U. S. S. Oklahoma.....	19	28	12	59
U. S. S. Detroit.....	15	39	3	57
U. S. S. Colorado.....	16	39	1	56
U. S. S. Nevada.....	31	17	1	49
<b>Scouting force:</b>				
U. S. S. Arkansas.....	16	38	21	75
U. S. S. Dobbin.....	5	9	48	62
U. S. S. Memphis.....	20	7	7	34
Asiatic Fleet: U. S. S. Black Hawk.....	6	12	88	106
Naval transportation service: U. S. S. Chaumont.....	77	6	31	114
<b>Total.....</b>	<b>537</b>	<b>551</b>	<b>313</b>	<b>1,401</b>

The U. S. S. *Colorado* reported 10 cases of measles in January, 8 in February, and 1 in March. This ship also notified 53 cases of influenza in March.

The U. S. S. *New York* and the U. S. S. *Wyoming* each reported 1 case of scarlet fever in January.

The Second Brigade, United States Marine Corps, Managua, Nicaragua, reported one fatal case of cerebrospinal fever in February.

The Fourth Brigade, United States Marine Corps, Shanghai, China, notified one death from smallpox in February. Vaccination history shows one primary take in 1929, one failure and two immunity reactions in 1931. The patient was admitted February 12 and died 10 days later with broncho-pneumonia as a complication.

TABLE No. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended March 31, 1932

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	70,914	39,029	17,108	109,943
All causes:				
Number of admissions.....	8,447	4,328	2,174	12,775
Annual rate per 1,000.....	476.46	443.57	508.30	464.79
Disease only:				
Number of admissions.....	7,801	3,968	2,010	11,769
Annual rate per 1,000.....	440.03	406.67	469.96	428.19
Communicable diseases, exclusive of venereal diseases:				
Number of admissions.....	3,014	2,122	831	5,136
Annual rate per 1,000.....	170.01	217.48	194.30	186.86
Venereal diseases:				
Number of admissions.....	2,700	730	598	3,430
Annual rate per 1,000.....	152.30	74.82	139.82	124.79
Injuries:				
Number of admissions.....	645	359	163	1,004
Annual rate per 1,000.....	36.38	36.79	38.11	36.53
Poisoning:				
Number of admissions.....	1	1	1	2
Annual rate per 1,000.....	0.06	0.10	0.23	0.07

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended March 31, 1932

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....		9,196	1,970	81,154	1,174	15,933	515	109,943
CAUSE—DISEASE								
Primary	Secondary or contributory							
Abscess, peritonsillar.....	Pneumonia, broncho.....			1				1
Abscess, shoulder.....	Septicemia.....			1				1
Alcoholism, acute.....	Myocarditis, acute.....					1		1
Anemia, splenic.....	Hemorrhage and shock.....			1				1
Aortitis.....	Valvular heart disease, aortic insufficiency.....			1				1
Appendicitis, acute.....	Peritonitis, general, acute.....			2				2
Do.....	Embolism, coronary artery.....			1				1
Arteriosclerosis, general.....	Myocarditis, chronic.....			1				1
Carbuncle, buttock.....	Septicemia.....			1				1
Carcinoma:								
Esophagus.....	Metastasis, lungs.....		1					1
Stomach.....	Obstruction, intestinal, from external causes.....			1				1
Cerebrospinal fever.....	None.....			1				1
Dilatation, cardiac, acute.....	do.....			1				1
Endocarditis:								
Acute.....	do.....					1		1
Chronic.....	Rheumatism, muscular.....		1					1
Acute ulcerative (malignant).....	None.....			1				1
Goiter, exophthalmic.....	Myocarditis, acute.....			1				1
Hemorrhage, cerebral.....	Cirrhosis, liver, atrophic.....		1					1
Do.....	None.....			1				1
Hernia, inguinal.....	Embolism, coronary artery.....					1		1
Influenza.....	Pneumonia, broncho.....					1		1
Nephritis, chronic.....	Pneumonia, lobar.....			2				2
Otitis, media, acute.....	Infarction, lung.....					1		1
Pancreatitis.....	None.....			1				1
Pansinusitis.....	Meningitis, cerebrospinal, acute.....			1				1
Pneumonia, broncho.....	None.....		1					1
Do.....	Pleurisy, suppurative.....			2				2

TABLE No. 1—Summary of morbidity in the United States Navy, etc.—Con.

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....		9,196	1,970	81,154	1,174	15,933	515	109,943
CAUSE—DISEASE								
Primary	Secondary or contributory							
Pneumonia, lobar.....	None.....			2		1		3
Do.....	Pleurisy, suppurative.....			1				1
Septic sore throat.....	Septicemia.....			1				1
Smallpox.....	Pneumonia, broncho.....					1		1
Syphilis.....	Poisoning, nearsphenamine, acute.....			1				1
Thrombosis, coronary.....	Myocarditis, chronic.....			1				1
Tonsillitis, chronic.....	Abscess, lungs.....					1		1
Tuberculosis, chronic pulmonary.....	None.....			1				1
Do.....	Meningitis, cerebrospinal, acute.....			1				1
Do.....	Pneumothorax.....			1				1
Do.....	Tuberculosis, intestines.....			1				1
Tumor, benign, mixed.....	Meningitis, cerebral.....		1					1
Total for diseases.....		4	1	31		8		44
CAUSE—INJURIES AND POISONING								
Primary	Secondary or contributory							
Asphyxiation (flame).....	Burn, multiple.....			1				1
Burn, multiple (gasoline).....	None.....			2				2
Crush:								
Chest.....	do.....			1				1
Head.....	do.....			1				1
Dislocation, atlanto-occipital articulation.....	do.....			1				1
Drowning.....	do.....			2				2
Do.....	Psychoneuritis, psychasthenia.....			1				1
Landplane crash: Drowning.....	None.....		1					1
Seaplane crash: Drowning.....	do.....		1					1
Fracture:								
Compound, skull.....	do.....			3				3
Do.....	Intracranial injury.....			1				1
Simple, skull.....	None.....			2				2
Do.....	Hemorrhage, epidural.....			1				1
Do.....	Intracranial injury.....			1		1		2
Hemorrhage, traumatic, cerebral (blow).....	None.....			1				1
Injuries, multiple extreme.....	do.....			3				3
Rupture, traumatic (aorta).....	do.....					1		1
Strangulation.....	Dementia præcox.....			1				1
Wound:								
Gunshot—								
Arm.....	Hemorrhage and shock.....			1				1
Chest.....	None.....			1				1
Head.....	do.....					2		2
Thorax.....	Hemorrhage, traumatic intrathoracic.....			1				1
Poisoning, carbon-monoxide gas.....	None.....			1				1
Total for injuries and poisoning.....		2		26		4		32
Grand total.....		6	1	57		12		76
Annual death rate per 1,000:								
All causes.....		2.61	2.03	2.81		3.01		2.77
Disease only.....		1.74	2.03	1.53		2.01		1.60
Drowning.....		.87		.15				.18
Injuries.....				1.08		1.00		.95
Poisoning.....				.05				.04

**ADMISSIONS FOR INJURIES AND POISONING, FIRST QUARTER, 1932**

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the first quarter, 1932, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, January, February, and March, 1932	Admission rate per 100,000 per annum	Admission rate per 100,000 year 1931
<b>INJURIES</b>			
Connected with work or drill.....	514	1,870	2,433
Occurring within command but not associated with work.....	293	1,066	1,649
Incurred on leave or liberty or while absent without leave.....	197	716	1,603
<b>All injuries.....</b>	<b>1,004</b>	<b>3,652</b>	<b>5,685</b>
<b>POISONING</b>			
Industrial poisoning.....	1	4	17
Occurring within command but not connected with work.....	1	4	35
Associated with leave, liberty, or absence without leave.....	0	0	22
<b>Poisoning, all forms.....</b>	<b>2</b>	<b>8</b>	<b>74</b>
<b>Total injuries and poisoning.....</b>	<b>1,006</b>	<b>3,660</b>	<b>5,759</b>

*Percentage relationships*

	Occurring within command				Occurring outside command	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty		Leave, liberty, or absent without leave	
	January, February, and March, 1932	Year 1931	January, February, and March, 1932	Year 1931	January, February, and March, 1931	Year 1931
Per cent of all injuries.....	51.2	42.8	29.2	29.0	19.6	28.0
Per cent of poisonings.....	50.0	23.4	50.0	46.8	0	29.8
Per cent of total admissions, injury, and poisoning titles.....	51.2	42.5	29.2	29.3	19.6	28.2

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

There were no cases during the first quarter of 1932 worthy of notice from the standpoint of accident prevention.

**STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS  
OF RECRUITS**

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

*Cumulative data*

	Number	Per cent of recruits received	Per cent of recruits reviewed
JAN. 1 TO DEC. 31, 1931			
All naval training stations:			
Recruits received during the period.....	7,071		
Recruits appearing before board of medical survey.....	227	3.21	
Recruits recommended for discharge from the service.....	122	1.73	53.74
JANUARY, FEBRUARY, AND MARCH, 1932			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	342		
Recruits appearing before board of medical survey.....	2	.58	
Recruits recommended for discharge from the service.....	2	.58	100.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	513		
Recruits appearing before board of medical survey.....	9	1.75	
Recruits recommended for discharge from the service.....	9	1.75	100.00
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	606		
Recruits appearing before board of medical survey.....	5	.83	
Recruits recommended for discharge from the service.....	0	0	0
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	345		
Recruits appearing before board of medical survey.....	14	4.06	
Recruits recommended for discharge from the service.....	4	1.16	28.57
Recruits held over pending further observation.....	10	2.90	71.43

The following table was prepared from reports of medical surveys in which disabilities or diseases causing the surveys were noted as existing prior to enlistment. The time which elapsed from date of enlistment to date of medical survey is noted in each case. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office. The difficulty in establishing a diagnosis in nervous and mental cases is demonstrated by the time interval in the table. An exception in this group is epilepsy, which may or may not diagnose itself promptly. Certain groups, of course, present difficulties in diagnosis at the time of enlistment due to lack of equipment.

Cause of survey	Number of surveys	Number of days between enlist- ment and survey
Arterial hypertension.....	1	9
Constitutional psychopathic state, emotional instability.....	1	20
Diabetes mellitus.....	1	152
Epilepsy.....	1	113
Do.....	1	7
Gonococcus infection, urethra.....	1	4
Hernia, inguinal.....	1	4
Hyperthyroidism.....	1	10
Malocclusion, teeth.....	1	4
No disease (undesirable).....	1	11
Perforated nasal septum.....	1	2
Stammering.....	1	4
Strabismus, internal, left.....	1	32
Syphilis.....	1	71
Tachycardia.....	1	13
Do.....	1	5
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